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REPORT OF THE CHIEF OF THE BUREAU OF PUBLIC ROADS

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF PUBLIC ROADS,
Washington, D. C., September 1, 1931.

SIR: I submit herewith the report of the Bureau of Public Roads for the fiscal year ended June 30, 1931.

Respectfully,

THOMAS H. MACDONALD,
Chief of Bureau.

HON. ARTHUR M. HYDE,
Secretary of Agriculture.

Road work of all kinds in which the Federal Government has participated through the agency of the Bureau of Public Roads has been greatly increased during the fiscal year 1931 with resulting large increases in the employment of labor.

In the Federal-aid road work the roads on which improvements were completed and paid for, including those improved for the first time with Federal aid and those further improved by stage construction or reconstruction, measured 11,033 miles. The corresponding figure for the preceding year was 8,682 miles.

At the close of the year the projects under construction totaled 16,480 miles as compared with the 9,916 miles that were in progress at the end of the preceding year.

During the year Federal-aid funds to the extent of $157,952,903 were obligated to new projects and $133,340,910 were actually paid to the States for work done on the Federal-aid highway system. The largest previous totals corresponding to these figures were the $102,498,084 obligated in 1930 and the $95,749,998 paid to States in 1925.

Yet, even these unprecedented figures do not measure fully the extent of the Federal Government's monetary contribution to the States for road work during the year. To them must be added the $76,777,000 of emergency advance funds obligated to projects and the $20,296,266 actually paid for work done during the last six months of the year. These funds were not appropriated until December 20, 1930. Yet their virtually complete expenditure for labor performed and materials supplied is assured by August 31.

In the national-forest road work the mileage of projects completed was slightly above the record of the preceding year—281 as compared with 267 miles—and the mileage under construction at the end of the year was more than 75 per cent greater than at the close of the preceding year.

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In the national parks 68 miles were completed and 328 miles were under construction, as compared with the corresponding figures of 89 and 67 miles a year ago.

EMPLOYMENT OF LABOR

By three separate actions taken during and shortly before the beginning of the last fiscal year the volume of Federal-aid road construction, normal during the previous eight years, was virtually doubled in the space of one year, and the labor employment afforded by the work correspondingly increased.

For the fiscal years 1925 to 1930, inclusive, the appropriations authorized were $75,000,000, and during that period the rate of construction—at first somewhat higher by virtue of available balances from earlier years—had settled down to the level fixed by these annual authorizations. The movement toward an increase in the volume of work came with the authorization by Congress of an additional appropriation of $50,000,000 for the fiscal year 1931. This authorization, made by the act approved April 4, 1930, increased the funds approved for appropriation for the year beginning July 1, 1930, from $75,000,000, as previously authorized, to $125,000,000, and the additional allowance, immediately apportioned, was available at once for allotment to new projects.

As stated in the last annual report, the States at once proceeded to adjust their plans to the increased rate and in the three months that remained of the fiscal year 1930 had obligated to projects $102,498,-083.84, instead of the approximate $73,000,000 which would otherwise have been absorbed.

Allotment of the balance of funds still unobligated continued at a rapid rate into the early months of the last fiscal year, and the beginning of construction on the new projects followed just as rapidly.

The effect of the increased authorization of funds is perhaps best reflected by the mileage of road under construction from month to month. At the end of January, 1930, the mileage under construction was 8,452. By the end of February it had fallen, because of the completion of work on old projects, to 8,204 miles, and by the end of March to 8,186 miles. At each of these periods the mileage under construction was approximately 500 miles less than at the corresponding date in 1929. If this parallelism of the course of the work in the two years had continued the mileage under construction at the end of April, 1930, would have been approximately the same as at the end of March and the upturn to be expected with the opening of the new construction season would have manifested itself in a moderate increase by the end of May.

But, instead of remaining at the March level, the mileage under construction at the end of April rose by more than 500 miles to 8,716 miles, a total slightly in excess of the figure for April, 1929, and by the end of May the mileage under construction—9,431 miles—instead of being about 500 miles less than at the corresponding date in 1929, was about 500 miles greater.

This increase in the volume of active construction work, following so closely after the increase of the authorized appropriation, was the result of the anticipation of the congressional action by the States in the earlier months of 1930. In June, 1930, just two months after the increase in the authorization, the volume of work done, as indicated by Federal aid earned, exceeded by 28 per cent the greatest volume of work completed in any previous June and was greater than the average for that month in the eight preceding years by nearly 75 per cent. In only three previous months during the entire history of the Federal-aid work had the volume of work performed and the amount of Federal aid earned, exceeded the amounts for this last month of the fiscal year 1930. This was the prompt result of the increase in the authorization from $75,000,000 to $125,000,000 a year.

In the next two months—the first of the last fiscal year—the drought which had set in early in the year reached the proportions of a national disaster. Threatened with heavy crop losses, farmers in a number of States faced a grim prospect with the onset of winter unless in some way they could find work which would provide the means to purchase their necessities.

With the purpose of affording through Federal-aid road work the greatest possible measure of relief consistent with the limitations of existing authorized appropriations, the Secretary of Agriculture apportioned the appropriation authorized for the fiscal year 1932 on September 1, 1930. Ordinarily this apportionment would not have been made until December.

Although at the time of this action there was still unobligated about $57,000,000 of the previously apportioned authorizations, the rate of obligation, i. e., initiation of new work, had begun to fall off rapidly and this reduction in the rate of initiation of projects could be expected in a few months hence to be reflected in the volume of active work. In June the amount obligated had been more than $17,500,000, a sum greater by nearly 20 per cent than the greatest amount obligated in any previous June and greater than in any other month of any previous year. By August the amount obligated in the monthly period had dropped to a little over $8,000,000, which was but little above the previous normal for the month.

This falling off in the aggregate rate of obligation with a considerable unobligated balance still on hand is explainable in two ways: (1) Available funds had been virtually exhausted in a number of States, and (2) other States which still had considerable balances unobligated were proceeding normally to absorb the money in the allotted time, believing that the new apportionment would not occur until the end of the calendar year as usual. To these there might perhaps be added one other reason already effective in a few States, namely, the virtual exhaustion of State funds with which to match the Federal apportionment.

The effect of the new apportionment was first evident in the obligations during October. September's total dropped to a little over

$6,500,000, just about the previous normal for the month, but October's aggregate, stimulated by the new apportionment, rose to more than $10,200,000, which was nearly twice the previous normal for the month, and although the November obligations declined to approximately $6,800,000, they were still nearly twice the previous normal for the month and were followed by more than $10,600,000 in December, which was nearly three times the previous December normal.

These heavy obligations in the fall of 1930 were the consequence of the early apportionment of the appropriation authorized for the fiscal year 1932. Meanwhile, favored by the extraordinarily mild and dry weather that prevailed generally, construction work was continued actively late into the fall and expenditure of the obligated funds was much greater than usual at this time of the year. Expenditures of State funds on the Federal-aid projects were, of course, correspondingly heavy and besides the Federal-aid work the States were also carrying on active work at an increased rate on independent State projects.

As a result of this uncommonly active prosecution of work and the long construction season, it became evident late in the autumn of 1930 that balances of available funds which under ordinary circumstances would have been carried over the winter to pay for work recommenced in the spring would this year be reduced in many States to negligible amounts. Since the renewal of resources depended in 43 States upon action of the legislatures, which in most cases did not convene until January 1 or later, it appeared that notwithstanding the availability of a large unobligated balance of Federal-aid funds there would be a period during the winter in which a number of States might find themselves unable to initiate new projects because of a lack of State funds with which to match the Federal aid.

At the same time it was becoming increasingly evident that there would be urgent need to provide every possible opportunity for employment to prevent actual suffering and want during the winter and early spring months.

It was to meet this situation that Congress on December 20 appropriated $80,000,000 to be apportioned among the States in the same manner as Federal aid and used by them in lieu of an equal amount of State money to match the regular Federal-aid funds. The act appropriating the money provided for the reimbursement of the Federal Treasury by deduction of the amounts actually expended by each of the States from their respective apportionments of future Federal-aid authorizations over a period of five years, beginning with the fiscal year 1933. It also limited the amounts to be advanced to the sums actually paid out by each State for work performed before September 1, 1931.

The effect of this act was immediate. Within seven days the first projects calling for a part of the money advanced were submitted by Delaware and Maryland. By the end of January—little more than a month after the appropriation—more than $15,000,000 had

been obligated to projects. By the end of February nearly half a million dollars had been earned by work completed. By June 30 nearly $77,000,000 had been allotted to projects and more than half of the appropriation had been earned, the money actually paid to workers and material producers. By August 31, the limiting date, the whole amount available for use on Federal-aid roads—the sum of $631,800 having been transferred at the request of the President to other road uses—had been allotted to projects, and although it is still too early to report exactly the amount earned, it is certain that it will come within $1,000,000 of the total appropriated.

When the apropriation was made available a condition existed in Arkansas as the result of the previous year's drought which made it particularly desirable to start road work promptly in order to relieve distress. By June 30, six months after the appropriation of this money, every cent of the Arkansas apportionment, which was $1,388,157, had been paid out by the State and passed into the hands of workers. But, although Arkansas was the first State to earn its entire apportionment, Iowa was the first to submit its claims in full and the first to be paid its full apportionment by the Federal Government. The last claim from this State was paid on August 7.

A full and exact report of the amounts paid to each State under this appropriation will be prepared at a later date when the final vouchers have been received from all States. A brief summarization of the operation is, however, herewith submitted in Tables 1 and 2, which, though subject to minor change, are substantially correct.

TABLE 1.—*Emergency advance fund apportionment and preliminary estimate of the amount earned to August 31, 1931*

State	Apportionment of the $80,000,000 emergency advance fund	Preliminary estimate of the amount earned to Aug. 31, 1931	State	Apportionment of the $80,000,000 emergency advance fund	Preliminary estimate of the amount earned to Aug. 31, 1931
Alabama	$1,698,645	$1,698,645	New Hampshire	$400,000	$400,000
Arizona	1,170,481	1,169,000	New Jersey	1,107,807	1,107,807
Arkansas	1,388,157	1,388,157	New Mexico	1,303,288	1,303,288
California	3,108,233	3,108,233	New York	4,050,566	4,050,566
Colorado	1,507,832	1,507,832	North Carolina	1,926,775	1,926,775
Connecticut	520,491	520,491	North Dakota	1,298,532	1,298,532
Delaware	400,000	400,000	Ohio	2,998,538	2,998,538
Florida	1,086,438	1,086,438	Oklahoma	1,926,351	1,926,351
Georgia	2,077,996	2,077,996	Oregon	1,320,287	1,270,000
Idaho	1,008,035	1,008,035	Pennsylvania	3,512,943	3,512,943
Illinois	3,400,116	3,400,116	Rhode Island	400,000	400,000
Indiana	2,045,929	2,045,929	South Carolina	1,114,636	1,114,636
Iowa	2,116,369	2,116,369	South Dakota	1,337,973	1,337,973
Kansas	2,192,301	2,192,301	Tennessee	1,741,882	1,741,882
Kentucky	1,504,715	1,504,715	Texas	5,088,080	4,880,218
Louisiana	1,147,927	981,156	Utah	926,521	926,521
Maine	715,799	715,799	Vermont	400,000	400,000
Maryland	678,752	678,752	Virginia	1,505,502	1,473,266
Massachusetts	1,141,460	1,141,460	Washington	1,270,933	1,270,933
Michigan	2,521,382	2,521,382	West Virginia	875,384	875,384
Minnesota	2,249,993	2,249,993	Wisconsin	1,992,410	1,992,410
Mississippi	1,434,736	1,434,736	Wyoming	1,029,383	1,029,383
Missouri	2,526,823	2,349,220	Hawaii	400,000	400,000
Montana	1,671,930	1,671,930			
Nebraska	1,708,031	1,708,031	Total	80,000,000	79,242,122
Nevada	1,049,638	928,000			

TABLE 2.—*Approximate summary of Federal-aid road operations, by months, under $80,000,000 emergency advance appropriation*

Date	Accumulated amount obligated to projects	Estimated accumulated amount earned by completion of work	Accumulated amount paid to States	Date	Accumulated amount obligated to projects	Estimated accumulated amount earned by completion of work	Accumulated amount paid to States
1931				1931			
Jan. 31	$15,366,000			May 31	$74,555,000	$20,365,000	$3,642,130.38
Feb. 28	37,716,000	$486,000		June 30	76,777,000	40,719,000	20,296,266.24
Mar. 31	57,728,000	2,582,000	$36,917.04	July 31	79,063,000	63,266,000	35,948,781.35
Apr. 30	69,168,000	8,409,000	402,991.35	Aug. 31	79,368,000	79,242,122	53,066,701.76

As stated above, the reason for the emergency advance appropriation was the knowledge that because of the depletion of their funds a number of States could not match the Federal aid available at the end of the calendar year 1930 and that initiation of new work would be retarded for this reason. The immediate result of the appropriation was largely to increase the obligation of regular Federal-aid funds. From $10,600,100 in December the obligations increased to $14,500,000 in January, to nearly $22,000,000 in February, and to more than $27,000,000 in March. These were by far the largest monthly obligations in the history of the Federal-aid work, and they were reflected quickly in the amount of active construction work.

As a result of the high rate of completion of projects made possible by the long working season of the previous year and the momentary lag in initiation of new work because of the depletion of State funds, the mileage of Federal-aid road under construction had dropped at the end of January, 1931, to 8,812 miles, but little larger than the total at the same date in 1930. But by March 31 the mileage had risen to 10,388, virtually the figure attained by July 31 in the previous year. And at the end of the fiscal year on June 30 there were under construction 16,480 miles, exceeding by several thousand miles the largest volume of work under construction at any one time in the whole course of the Federal-aid program.

In the foregoing it has been the purpose to trace separately the separate effects of the three principal actions successively taken between April and December, 1930, to increase largely and quickly the size of the Federal-aid road construction program as a means of providing employment for idle labor.

The combined effects of all three actions were manifest in the extraordinarily large amount of construction work carried on during the first six months of the present year and the remarkably early beginning of this work. The records show that the mileage of road under construction at the end of February this year was greater than at the end of May last year, and by the end of March of the present year work was under way on a mileage of road practically equal to that which was under construction at the end of July, 1930.

Virtually complete reports of labor employed on the various classes of road work under the supervision of Federal and State agencies have been received by the bureau monthly since March by arrangement with the several State highway departments. The average number of persons employed each month on each class of work as

shown by these reports is shown in Table 3, summarized for the entire United States.

TABLE 3.—*Average number of persons employed directly on various classes of road work under the supervision of Federal and State agencies, by months, from March to June, 1931, inclusive*

Month	Construction of roads							Maintenance of roads	Total
	National forest roads	National park roads	Federal-aid roads		Total Federal and Federal aid	State and State aid	Total on construction		
			Regular projects	Emergency projects [1]					
March	1,278	172	28,068	25,334	54,852	58,701	113,553	92,889	206,442
April	2,619	350	39,415	55,099	97,483	72,250	169,733	90,129	259,862
May	3,684	1,002	39,518	82,387	126,591	89,804	216,395	95,050	311,445
June	4,660	2,168	40,223	107,402	154,453	101,311	255,764	111,053	366,817

[1] Under this head the figures represent the number of men employed on Federal-aid projects on which a portion of the State's share of the cost was paid with money advanced by the Federal Government under the appropriation of Dec. 20, 1930.

It will be noted that the average number of persons employed on all Federal and Federal-aid road construction, including the national-forest and park work, increased from 54,852 in March to 154,453 in June, a gain of 100,000 in the three months. In March the number given employment by the Federal and Federal-aid work was a little over a fourth of the total employed on all Federal and State work, which was 206,442. In June the Federal work employed 42 per cent of the total of 366,817 persons, the average number reported as employed on all Federal and State work. The figures given in Table 3 do not include the large numbers of laborers engaged upon road and street construction and maintenance under the administration of city, county, and township authorities, and represent only persons directly employed upon road construction and maintenance work of the Federal and State Governments.

We have estimated that for every person directly employed on the road work proper two others are employed on the average in the manufacture and transportation of road materials and equipment. The estimate has been subjected to a number of tests and appears reasonable. Assuming that it is approximately correct, the total employment furnished by the Federal and Federal-aid road work in June, 1931, was probably equivalent to the full time of more than 460,000 persons, and the Federal and State work combined probably furnished employment to over 1,000,000 persons.

We have estimated that the number of persons directly employed in June, 1930, on road work supported in whole or in part by Federal funds was approximately 64,000, or less by 90,000 than the 154,000 directly employed on work of like character in June, 1931.

PROGRESS IN FEDERAL-AID ROAD CONSTRUCTION

Initial improvements were completed during the fiscal year on 7,938.8 miles of the Federal-aid highway system; advanced stages of construction were completed on 3,082.5 miles; and 12 miles previously improved were reconstructed. The total mileage upon which im-

provements were completed was therefore 11,033.3 miles. These projects, classed as completed, were not only physically completed but had also been paid for to the full extent of its obligation by the Federal Government.

In addition to these projects, there were others on which at the end of the year all work was physically completed to the satisfaction of the bureau, and only the final payment of Federal money remained to discharge the Government's full obligation. Projects in this stage have previously been reported as completed, but, since it is not possible to report the exact cost and Federal expenditure until the final voucher has been paid, it has been deemed proper this year to report such projects separately and to indicate clearly that the total cost and Federal-aid reported are approximate.

In projects at this stage of progress there were at the end of the year 2,131.9 miles of initial construction, 881.4 miles of stage construction, and 17.5 miles of reconstruction, a total of 3,030.8 miles.

At the close of the year construction of initial improvements was in progress on 12,305.8 miles, and other initial improvements had been approved for 1,945.6 miles. Stage construction was in progress on 4,138.5 miles already initially improved with Federal aid, and similar advanced improvements had been approved of 1,033.3 miles. In addition, 35.5 miles of roads previously improved were in process of reconstruction.

The total mileage on which inital improvements had been completed and the final payment made by the Federal Government up to the beginning of the fiscal year was 90,755.2. In addition, there had been physically completed and opened to traffic 2,131.9 miles upon which some money was still due to the States for work done. Initial improvements had thus been physically completed on 92,887.1 miles included in the system on June 30. At that time, however, 4,174 miles included in the above were undergoing stage construction or reconstruction, and were, therefore, temporarily removed from the mileage available for travel, so that the bureau classifies as completed on June 30 last only 88,713.1 miles. The location of this mileage by States is shown in Table 17. Its classification by types and location is shown in Table 22.

As required by law, the progress of improvement on the entire Federal-aid highway system is each year charted on maps which are revised, as nearly as possible, annually. During the last fiscal year such maps showing the progress of construction in 46 of the 48 States were published.

Since the law requires that such maps shall show the condition of the whole system, including parts on which no Federal money has been expended, it is necessary that the bureau regularly compile information on work done independently by the States on the system as well as the work in which the Federal Government cooperates.

To present the required map record of progress it has been necessary to publish sectional maps of the United States on 108 sheets each 22 by 32 inches in size. On these sheets the location of the Federal-aid system is plotted and the various types of construction employed on each section of the system, whether by the States alone or with Federal aid, are indicated by appropriate symbols.

Official distribution is made to other Government agencies, State highway departments, map-publishing companies, recognized tour-

ing agencies, and free public libraries, aggregating over 19,000 maps. A number of the libraries have obligated themselves to provide suitable binders or containers so that the maps may be freely available and conveniently consulted.

Under arrangement with the Superintendent of Documents, separate copies for each State may be purchased at the nominal price of 10 cents per sheet.

STAGE CONSTRUCTION AND RECONSTRUCTION

As in previous years, advanced stages of improvement have been carried forward on portions of the Federal-aid system previously improved with Federal aid concurrently with the extension of initially improved mileage. Also, as in the preceding year, there has been a small amount of reconstruction of roads previously improved with Federal aid.

As explained in the last annual report, there is a clear distinction between stage construction and reconstruction. The former represents a continuation of work anticipated as eventually necessary at the time of the original improvement but deliberately deferred for one reason or another, generally because it is undesirable to expend more money upon the improvement at the moment. Reconstruction, however, becomes necessary when an improvement originally believed to be adequate is overtaxed by an unanticipated increase in traffic, or simply when a surface originally adequate and perhaps still adequate for the traffic, wears out. It is now 14 years since the Federal-aid policy was inaugurated and it may be expected that henceforth there will be from year to year a certain amount of reconstruction becoming heavier as years go on. For, even with the best of maintenance, some of the earlier improvements of the less durable sort are now approaching the limit of their life.

As year follows year the ratio of stage construction to initial construction operations increases. This is clearly shown by Table 4, in which it will be seen that the stage construction has increased from a mileage equal to only 1.2 per cent of the year's initial improvements in 1923 to a mileage equal to 38.8 per cent of the initial construction in 1931.

TABLE 4.—*Mileage of initial construction, stage construction, and reconstruction completed and final payment made, by fiscal years 1923–1931, inclusive*

Fiscal year	Mileage of initial construction completed and paid for	Stage construction completed and paid for		Reconstruction completed and paid for		Mileage of total construction
		Mileage	Percentage of initial construction	Mileage	Percentage of initial construction	
1923	9,940.5	117.8	1.2			10,058.3
1924	9,145.6	280.7	3.1			9,426.3
1925	9,437.1	495.3	5.3			9,932.4
1926	10,533.3	783.9	7.4			11,317.2
1927	8,413.5	1,376.6	16.4			9,790.1
1928	8,532.2	2,088.8	24.5			10,621.0
1929	7,267.4	2,069.7	28.5			9,337.1
1930	6,675.4	1,988.0	29.8	18.8	0.3	8,682.2
1931	7,938.8	3,082.5	38.8	12.0	.2	11,033.3

This increase is the natural result of the policy that has been followed for years under which the first endeavor has been to spread a certain minimum of improvement over as large a mileage as possible and subsequently, as rapidly as funds became available or the need became acute, to further improve the roads already improved to some degree.

Under this policy many thousands of miles have been improved initially only by grading and draining, with a definite understanding expressed in the agreements with the States that surfacing and further improvement would be added in due time.

The stage-construction work does not increase the mileage of improved road but it is constantly raising the standard of improvement of the system; and it is due to the stage-construction work that although each year the initial-improvement work adds many miles of low-type improvement, the total mileage of these types is either increasing very slowly or actually decreasing. On the other hand, the mileage of high-type improvement is increasing at a more rapid rate than the initial improvements of this class would indicate.

These effects of stage construction are brought to light by a comparison of Tables 23 and 31, the first presenting the mileage of each type of highway initially completed and paid for during the last fiscal year, and the second, the net change in the mileage of each type of improvement in the portion of the system improved with Federal aid.

Thus it will be seen that although during the year there was an initial improvement of 1,854.4 miles merely by grading and draining, the mileage of road thus simply improved in the system actually shrank during the year by over 1,200 miles. And, although the year's completion of initial concrete pavements was only 3,160.3 miles, the mileage of this high type of pavement in the system increased by 4,316.5 miles.

Detailed information in regard to stage construction completed, in process, and approved will be found in Tables 18–21 and 27–30.

Information on the small mileage of reconstruction work will be found in Tables 5–11 and 18–20. In Tables 8–11, which show the old and new surface types of mileage that has been reconstructed or is now being reconstructed, and the age at the time of reconstruction, it will be seen that in every instance the new construction is of a type at least as high as the original and in nearly every instance higher.

The general age of the original surfaces at the time of reconstruction ranged from 9 to 12 years. The only surfaces below 9 years of age at the time of reconstruction were 2 of gravel—1, in Louisiana, 4 years old, and the other, in Vermont, 5 years old.

TABLE 5.—*Federal-aid projects on which reconstruction had been completed and paid for during fiscal year 1931*

State	Total cost	Federal aid	Miles	State	Total cost	Federal aid	Miles
Maine	$78,476.74	$23,190.00	1.6	Oklahoma	122,289.26	60,763.24	2.7
Massachusetts	101,799.71	39,225.00	2.6	Vermont	52,258.11	21,495.00	1.4
New Hampshire	241,861.41	55,155.00	3.7	Total	596,685.23	199,828.24	12.0

TABLE 6.—*Federal-aid projects on which reconstruction had been completed, but final payment not made, as of June 30, 1931*

State	Estimated total cost	Federal aid allotted	Miles
Maryland	$587,282.72	$284,646.88	11.7
Oklahoma	160,506.17	62,846.59	5.8
Total	747,788.89	347,493.47	17.5

TABLE 7.—*Federal-aid projects on which reconstruction was in progress on June 30, 1931*

State	Estimated total cost	Federal aid allotted	Miles
Maryland	$150,870.25	$46,100.00	1.8
Michigan	763,792.32	243,375.00	16.1
Nevada	327,117.79	198,652.66	9.2
Oklahoma	185,963.65	102,767.15	8.4
Total	1,427,744.01	590,894.81	35.5

TABLE 8.—*Federal-aid projects on which reconstruction had been completed on June 30, 1931, by types of construction*

State	Age	Original type							
		Gravel, untreated		Bituminous macadam		Bituminous concrete		Portland cement concrete	
		New type	Miles	New type	Miles	New type	Miles	New type	Miles
	Years								
Louisiana	4	Bituminous concrete.	7.5						
Maine	9			Concrete	1.6				
Do	7			do	1.9				
Maryland	8			do	6.6				
Do	11							Concrete	5.9
Do	11			Concrete	5.8				
Massachusetts	8			do	2.7				
Do	10					Bituminous macadam.	2.6		
New Hampshire	12					Concrete	1.2		
Do	12					do	.5		
Do	10					do	2.0		
Oklahoma	9	Concrete	2.6						
Do	9	Bridge	.1						
Do	9	Concrete	2.5						
Do	9	do	3.3						
Vermont	5	do	1.4						

TABLE 9.—*Federal-aid projects on which reconstruction had been completed and paid for during the fiscal year 1931, by types of construction*

State	Age	Original type					
		Gravel, untreated		Bituminous macadam		Bituminous concrete	
		New type	Miles	New type	Miles	New type	Miles
	Years						
Maine	9			Concrete	1.6		
Massachusetts	10					Bituminous macadam	2.6
New Hampshire	12					Concrete	1.2
Do	12					do	.5
Do	10					do	2.0
Oklahoma	9	Concrete	2.6				
Do	9	Bridge	.1				
Vermont	5	Concrete	1.4				

TABLE 10.—*Federal-aid projects on which reconstruction had been completed, but final payment not made, as of June 30, 1931, by types of construction*

State	Age	Original type					
		Gravel, untreated		Bituminous macadam		Bituminous concrete	
		New type	Miles	New type	Miles	New type	Miles
	Years						
Maryland	11					Concrete	5.9
Do	11			Concrete	5.8		
Oklahoma	9	Concrete	2.5				
Do	9	do	3.3				

TABLE 11.—*Federal-aid projects on which reconstruction was in progress on June 30, 1931, by types of construction*

State	Age	Original type							
		Gravel, untreated		Bituminous macadam		Bituminous concrete		Portland cement concrete	
		New type	Miles	New type	Miles	New type	Miles	New type	Miles
	Years								
Maryland	9			Concrete	1.5				
Do	11			do	.3				
Michigan	8					Concrete	10.0		
Do	6	Concrete	1.3						
Do	6	do	4.8						
Nevada	8							Bituminous concrete.	9.2
Oklahoma	9	Concrete	4.5						
Do	9	do	3.9						

CHANGES IN THE FEDERAL-AID HIGHWAY SYSTEM

In the last annual report the mileage of the Federal-aid system within the boundaries of national forests, Indian reservations, and other Federal reservations was reported as 5,456.11 miles as determined up to the close of the fiscal year 1930. During the past year further determinations have increased this mileage to 5,580.07, located, by States, as shown in Table 12.

TABLE 12.—*Mileage of Federal-aid highway system within Federal reservations, being the amounts by which the 7 per cent limiting mileage may be exceeded in each State or Territory*

State	Mileage within Federal reservations	State	Mileage within Federal reservations
Arizona	547.20	New Mexico	368.88
Arkansas	119.70	New York	16.47
California	457.00	North Carolina	176.34
Colorado	423.50	North Dakota	23.39
Georgia	57.80	Oklahoma	16.25
Idaho	468.40	Oregon	360.10
Illinois	4.50	Pennsylvania	108.21
Iowa	2.00	South Dakota	474.50
Kansas	14.70	Tennessee	66.04
Kentucky	6.00	Utah	68.90
Maine	4.50	Virginia	30.72
Michigan	26.50	Washington	353.21
Minnesota	74.80	West Virginia	29.06
Mississippi	10.40	Wisconsin	45.50
Montana	878.82	Wyoming	275.90
Nebraska	11.25	Hawaii	4.34
Nevada	21.77		
New Hampshire	33.42	Total	5,580.07

Under the amendment of the Federal highway act approved May 21, 1928, the original 7 per cent system in the several States may be increased by these mileages within Federal reservations, and such addition raises the permissible mileage of the initial system to 206,142 miles.

By addition to the system during the past year, made possible in part by the provisions of the amendment of May 21, 1928, the mileage of the initial system has been increased to 194,294 miles. This mileage has been further increased by extension of the system in six States in which the initial 7 per cent system has been improved to the satisfaction of the Secretary of Agriculture. The States in which such extensions have been approved are: Connecticut, in which the extension is 63.66 miles; Delaware, 341.83 miles; Maryland, 791.55 miles; New Jersey, 116.20 miles; New York, 984.10 miles; and Rhode Island, 286.06 miles. The sum of these extensions, being 2,583.40 miles, added to the initial system thus far designated, raises the mileage of the total system to 196,877 miles as of June 30, 1931, an increase of 3,827 miles in the last year.

The mileage of the designated Federal-aid system in each State, including the authorized extensions in the six States mentioned, and the mileage within Federal reservations is given in Table 17, which also shows the distribution, by States, of the 88,713.1 miles classified as completed on June 30, 1931.

The mileage classified as completed with Federal aid still includes some roads improved before 1921 and not since included in the designated Federal-aid system. These roads, if found not sufficiently important to be added to the designated system, gradually are being dropped and the Federal money invested in them transferred as a credit to the improvement of other roads in the system.

A year ago it was reported that the Federal aid originally paid for the improvement of 696 miles of such roads outside of the system had been transferred to other roads within the system. The continuation of this procedure during the past year has returned to

the Government the amount originally expended on other roads outside the system totalling 315.3 miles, and this money has been allotted to the initial or stage construction of other roads within the system.

The mileage classified as improved has also been reduced this year by reductions in the length of previously improved roads by relocations effected in stage construction, aggregating 36.2 miles.

BRIDGE CONSTRUCTION

The bridges completed as initial improvement and fully paid for during the fiscal year have with their approaches an aggregate length of 56.4 miles. Those added by stage construction completed and fully paid for aggregate 7.5 miles, making a total of 63.9 miles of bridges and their approaches completed and fully paid for during the fiscal year. In addition there were physically completed 25.2 miles of bridges as initial construction and 3 miles as stage construction, a total of 28.2 miles, on which the full share of the Federal Government has not yet been paid.

Including the structures just completed, the Federal-aid bridges completed and fully paid for by the Federal Government to date have a total length, with their approaches, of 389.7 miles.

A list of bridges completed during the year which cost $75,000 or more is given in Table 13. These, the longest and most expensive of the projects completed, range in length from about 0.1 mile to 3.7 miles, and have an aggregate length with their approaches of 21.8 miles. The rest of the completed mileage is made up of numerous smaller and less expensive bridges, each more than 20 feet in span.

TABLE 13.—*Federal-aid bridges completed during the fiscal year 1931 at a cost of $75,000 or more each*

State	Location	Stream or railroad	Estimated total cost	Length of bridge and approaches
				Miles
Arizona	Phoenix-Gila Bend Road near Coldwater.	Agua Fria River	$168,800	0.2
	Benson-Douglas Highway	San Pedro River	76,000	.1
California	Red Bluff-California-Oregon State line.	Cottonwood Creek	161,300	.2
	Near Cottonwood	Underpass Southern Pacific R. R.	138,000	.2
	San Lucas-Santa Maria	Salinas River	231,000	.3
	Victorville-Barstow	Mojave River	125,000	.1
	Stockton-Sacramento Road near Lodi.	Mokelumne River	91,900	.2
Colorado	Lamar-Las Animas	Arkansas River	145,000	.2
	Grand Junction-Palisades Highway.	Overpass Denver & Rio Grande Western R.R.	76,600	.5
Connecticut	Boston Post Road-Fairfield-Westport.	Southport Cutoff-New York, New Haven & Hartford R. R.	454,700	.6
	Norwich-Putnam Highway	Quinnebaugh River	500,800	.5
	do	Tadpole Crossing-New York, New Haven & Hartford R. R.	77,400	.2
Florida	Live Oak-Madison	Suwannee River	126,800	.2
	Tampa-Bradenton at Riverview.	Alafia River	103,900	.1
Indiana	Indianapolis-Jeffersonville Highway.	Overhead Bridge Pennsylvania R. R.	109,900	.1
Kentucky	Louisville-Bardstown	Salt River	113,600	.1
	Harlan-Whitesburg Highway	Poor Fork of Cumberland River.	98,700	.1

TABLE 13.—*Federal-aid bridges completed during the fiscal year 1931 at a cost of $75,000 or more each*—Continued

State	Location	Stream or railroad	Estimated total cost	Length of bridge and approaches
				Miles
Louisiana	Near Oberlin	Calcasieu River	$110,800	0.3
	Tallulah-Monroe	Boeuf River	77,300	.1
	Jonesville-Harrisonburg Highway.	Little River	127,300	.1
	New Orleans-Chef Menteur Highway.	Chef Menteur Pass	591,700	.2
	do	Rigolets Pass	1,350,000	3.7
Maine	At Edgecomb	Cod Cove	118,200	1.1
Massachusetts	New Bedford-Wareham	Weweantic River (3 bridges)	149,900	.1
Michigan	Ann Arbor-Ypsilanti Highway.	Ann Arbor R. R. and State Street.	138,300	.3
	Muskegon-Ludington	Muskegon River-Cedar Creek (3 bridges).	380,600	1.4
	Dix-Toledo Road	Underpass Detroit, Toledo & Ironton R. R.	172,900	.3
Minnesota	Champlen-Anoka	Mississippi River	398,400	.2
	Big Lake-Montrose	do	158,900	.2
Mississippi	Gulfport-Pascagoula	Biloxi Bay	764,100	1.5
	Columbus-Aberdeen	Tombigbee River	91,900	.1
	South edge of Vicksburg	Overpass Yazoo & Mississippi Valley R. R.	84,300	.1
Missouri	Carrollton-Keytesville Highway.	Grand River	185,700	.3
	Bowling Green-Wentzville Highway.	Cuivre River	104,300	.1
Montana	Livingstone-Laurel	Yellowstone River	78,300	.1
	Knowles-Weeksville Road	Clark Fork River	188,900	.2
	Dillon-Butte Road	Nissler Viaduct over Great Northern R. R.	78,800	.1
	Wolf Point-Circle Road	Little Wolf Creek	100,500	.1
	do	Missouri River	361,200	.1
Nebraska	White Way near Clarks	Platte River	85,400	.2
New Hampshire	Potter Place-Lebanon	Overpass Boston & Maine R. R.	98,600	.4
New Jersey	Jersey City-Newark Highway	Passaic River	682,900	.2
New Mexico	Aztec-Farmington Highway	Las Animas River	105,200	.6
North Carolina	Weldon-Pleasant Hill Road	Roanoke River	225,600	.3
Ohio	Perrysburg-Maumee	Maumee River	351,100	.7
	Columbus-Lancaster Highway.	Underpass Hocking Valley R. R.	107,600	.2
	Southeast of Centerburg	Underpass New York Central R. R.	117,900	.2
Oklahoma	Perkins-Coyle	Cimarron River	93,900	.2
	West of Spur	Boggy Creek	149,600	.2
	Waurika, Okla.-Ringgold, Tex.	Red River	145,200	.2
Oregon	Grants Pass	Rogue River	125,900	.1
Pennsylvania	Lemoyne-Duncannon	Sherman Creek	85,600	.1
	Bedford-McConnellsburg	Juniata River	202,800	.1
	Erie-Waterford	Mill Creek	144,700	.1
Rhode Island	Providence-East Greenwich	Overpass New York, New Haven & Hartford R. R.	132,400	.3
	Hope-Anthony	Pawtuxet River	75,200	.1
	Alton-Bradford	Wood River	132,900	.2
Texas	Houston-Beaumont Road	Trinity River	201,000	.3
	State Highway 5, Route 5	Red River & South Plains R. R.	179,800	.5
	Madisonville-Crockett	Trinity River	260,100	.7
	Forney-Dallas-Kaufman County line.	East Fork Trinity River	91,600	.3
	West of Edna	Lavaca River	92,100	.2
	Jacksonville-Athens	Neches River	75,100	.2
Virginia	Jackson's Ferry	New River	87,800	.1
	At Glenlyn	do	104,700	.2
Washington	At Prosser on Inland Empire Highway.	Yakima River	84,800	.1
West Virginia	At Shinnston	West Fork River	144,100	.1
Wisconsin	At Princeton	Fox River	83,600	.1

CONSTRUCTION OF ROADS THROUGH PUBLIC LANDS AND FEDERAL RESERVATIONS

By the act approved June 24, 1930, the Secretary of Agriculture was authorized to cooperate with State highway departments and the Department of the Interior in the survey, construction, recon-

struction, and maintenance of main roads through unappropriated or unreserved public lands, nontaxable Indian lands, or other Federal reservations other than forest reservations. The act provided that sums which might be subsequently authorized to be appropriated for this purpose should be apportioned among States having more than 5 per cent of their area in lands of the kind described and prorated to such States in the proportion that the area of such lands in each bears to the total area of the lands in all eligible States. No contribution was required of the States, and it was provided that in the allocation of such funds as might be authorized preference should be given to projects located on the Federal-aid highway system.

The emergency employment act of December 20, 1930, appropriated $3,000,000 for this purpose. After deduction of the 2½ per cent administrative allowance the remaining sum of $2,925,000 was apportioned as required by law among the 13 eligible States as shown in Table 14.

TABLE 14.—*Apportionment and obligation of appropriation for roads through public lands and Federal reservations*

State	Sum apportioned	Sum obligated by June 30, 1931	State	Sum apportioned	Sum obligated by June 30, 1931
Arizona	$416,328	$416,328.00	Oregon	$193,377	$173,042.75
California	230,614		South Dakota	65,715	
Colorado	130,197		Utah	326,633	326,027.47
Idaho	174,316	73,997.99	Washington	55,165	55,165.00
Montana	164,521	66,378.26	Wyoming	280,916	229,881.60
Nevada	588,914	200,933.98			
New Mexico	256,790		Total	2,925,000	1,541,755.05
Oklahoma	41,464				

The rules and regulations promulgated by the Secretary of Agriculture on December 29, 1930, construed the term "main roads" as used in the act of June 24, 1930, to include sections of the Federal-aid highway system, continuations thereof, and necessary connections between routes thereon, and required that projects be selected and recommended jointly by the district engineers of the Bureau of Public Roads and the interested State highway departments. The rules and regulations also permitted work to be undertaken by either the States or the Federal agency, as might be provided by project agreements entered into between the State highway departments and the Secretary of Agriculture.

By the end of the fiscal year $1,541,755.05 of the money apportioned had been obligated to definite projects and the balance will be obligated early in the next fiscal year. The portion of each State's apportionment obligated on June 30, 1931 is shown in Table 14.

In selecting projects preference has been given, as required by law, to roads in the Federal-aid system as approved at present; and those projects which lie on roads not at present in the system are on roads of such importance that it is considered likely they will be taken into the system by future extensions.

Thus far only two projects have provided for surveys only and one has provided for surveys and the preparation of plans together with

construction. All other projects involve construction only, and no requests have been received for the use of any part of the money for maintenance purposes.

FEDERAL FUNDS APPORTIONED, OBLIGATED, AND EXPENDED

The appropriation for the fiscal year 1931 was authorized in two parts. The first part—$75,000,000—was apportioned on December 2, 1929. The second part—$50,000,000—authorized by the act approved April 4, 1930, was apportioned April 7, 1930. In each case the 2½ per cent allowed by law for Federal administration and research was deducted before the authorized funds were apportioned, so that the total sum apportioned was $121,875,000 and the amounts credited to each State are as shown in Table 32.

The balance of all funds apportioned that were unobligated at the beginning of the fiscal year was $75,716,790.80, i. e., there had been obligated to projects at the beginning of the fiscal year the equivalent of all funds apportioned for prior fiscal years and over $46,000,000 of the funds apportioned for the fiscal year then beginning.

On September 1, 1930, the appropriation authorized for the fiscal year 1932 was apportioned. The total of this authorization was also $125,000,000 and the amount apportioned after deduction of the administrative and research percentage was again $121,875,000, which amount increased the total sum available for allotment to projects during the fiscal year to $197,591,790.80.

The amount obligated during the year reached the unprecedented total of $157,952,902.76, a sum almost twice the average amount obligated annually from 1923 to 1929 and more than $55,000,000 greater than the amount obligated during the fiscal year 1930, which was the largest sum obligated in any year up to that time.

As a result there remained available for allotment to new projects on July 1, the first day of the fiscal year 1932, only $39,638,888.04. Of this amount, $2,378,280.39 consisted of unobligated 1931 funds credited to the States of Alabama, Florida, and Mississippi, and the Territory of Hawaii, and $880,000 consisted of the sum authorized by an act approved February 23, 1931, to be paid to Hawaii from funds theretofore authorized, appropriated, allocated, and unobligated for road construction in the Territory, the sum appropriated being equal to the amount the Territory would have received for roads built and incorporated into the 7 per cent system as approved during the period from 1917 to 1925.

The remainder of the amount unobligated on July 1 consisted of funds authorized for the fiscal year 1932 in the amount of $36,380,607.65. No other year since 1919 has opened with so small a balance of unobligated funds, notwithstanding the fact that the amount apportioned within the preceding 18 months largely exceeded the amount apportioned in any previous like period. This condition is the result of the special effort put forth during the past year by the Federal and State agencies to increase the rate of progress as greatly as possible in order to increase employment.

As stated in the report for the fiscal year 1930, the Territory of Hawaii had failed by June 30, 1930, to expend $326,864.96 of the sum apportioned to it for the fiscal year 1928. In accordance with

the provision of law that requires that amounts unexpended of sums apportioned to any State for any year by the end of the second succeeding fiscal year shall be reapportioned among all the States, the above amount was reapportioned on August 29, 1930. The amounts apportioned to the several States are shown in Table 15.

TABLE 15.—*Reapportionment of the portion of funds apportioned to the Territory of Hawaii for the fiscal year 1928 unexpended on June 30, 1930*

State	Sum apportioned	State	Sum apportioned
Alabama	$7,015.00	Nevada	$4,288.00
Arizona	4,742.00	New Hampshire	1,634.00
Arkansas	5,832.00	New Jersey	4,199.00
California	11,214.00	New Mexico	5,322.00
Colorado	6,211.00	New York	16,098.00
Connecticut	2,125.00	North Carolina	7,702.00
Delaware	1,634.00	North Dakota	5,369.00
Florida	4,139.00	Ohio	12,295.00
Georgia	8,893.00	Oklahoma	7,838.00
Hawaii	1,634.96	Oregon	5,357.00
Idaho	4,169.00	Pennsylvania	14,798.00
Illinois	13,813.00	Rhode Island	1,634.00
Indiana	8,508.00	South Carolina	4,747.00
Iowa	8,933.00	South Dakota	5,509.00
Kansas	9,113.00	Tennessee	7,207.00
Kentucky	6,320.00	Texas	20,437.00
Louisiana	4,681.00	Utah	3,799.00
Maine	3,009.00	Vermont	1,634.00
Maryland	2,821.00	Virginia	6,383.00
Massachusetts	4,865.00	Washington	5,206.00
Michigan	9,796.00	West Virginia	3,553.00
Minnesota	9,380.00	Wisconsin	8,248.00
Mississippi	5,926.00	Wyoming	4,207.00
Missouri	10,613.00		
Montana	6,921.00	Total	326,864.96
Nebraska	7,093.00		

The expenditure of Federal-aid funds during the fiscal year 1930 was $75,880,862.84. For several years the expenditure had regularly exceeded the amount authorized to be appropriated. The unexpended balances of prior appropriations had permitted this result. These had finally been virtually exhausted and the expenditure exceeded only slightly the year's apportionment of $73,125,000.

In the report submitted last year it was pointed out that the large increase in funds obligated, as a result of the increase in the authorization to $125,000,000, might be expected to result in a considerable increase in expenditure this year; but it was added that the annual expenditure would not reach the rate fixed by the new authorizations of $125,000,000 for at least two years or perhaps longer.

This estimate was based upon the experience of past operations. The fact that the total expenditure this year, within 15 months of the increase in the authorization, has mounted not merely to the amount apportioned but to $133,340,910.64, is simply another indication of the clerity with which work has been prosecuted this past year.

The largest disbursement in any previous year was nearly $96,000,000, paid to the States in the fiscal year 1925. In no other year has the expenditure reached $90,000,000.

A comparison of the amounts apportioned for and obligated and paid during each fiscal year from 1923 to 1931, inclusive, is presented in Table 16.

TABLE 16.—*Federal-aid funds apportioned to the States, obligated to projects and paid to the States each fiscal year from 1923 to 1931, inclusive*

Fiscal year	Apportioned amount of appropriation authorized for the year	Amount of Federal-aid funds obligated during the year	Amount of Federal-aid funds paid to States during the year
1923	$48,750,000	$77,461,559	$69,677,241.86
1924	63,375,000	89,866,864	79,217,397.90
1925	73,125,000	87,294,396	95,749,998.11
1926	73,125,000	79,608,897	87,754,534.57
1927	73,125,000	77,453,046	81,371,013.03
1928	73,125,000	88,922,185	80,802,232.55
1929	73,125,000	70,428,896	82,097,380.38
1930	73,125,000	102,498,084	75,880,862.84
1931	121,875,000	157,952,903	133,340,910.64
Total	[1] 672,750,000	831,486,830	[1] 785,891,571.88
Average	74,750,000	92,387,425	87,321,285.76

[1] The excess of total payments over total apportionments for these years was possible because of the fact that from 1917 to 1922 inclusive the appropriations exceeded the payments by more than an equal amount.

COST OF THE ROADS

The total cost of the 7,938.8 miles of initial construction, the 3,082.5 miles of stage construction, and the 12 miles of reconstruction completed and completely paid for during the year was $255,088,414.09, of which the Federal Government paid $105,918,451.14, or 41.5 per cent, and the States the balance. These expenditures were made over the period required to construct the roads, and during the same period there were additional expenditures for other projects under construction and not yet completed.

As previously stated, the total of Federal funds disbursed during the year on all active projects was $133,340,910.64, as shown in Table 32. Of this sum, the largest amount paid in any one year, 1 State, Texas, received more than $7,000,000; 2, Pennsylvania and Ohio, received more than $6,000,000; 2, Illinois and Missouri, received more than $5,000,000; 3, Georgia, Iowa, and Oklahoma, received more than $4,000,000; and 12, Arizona, Arkansas, California, Kansas, Kentucky, Minnesota, Montana, New Mexico, New York, North Carolina, Tennessee, and Wisconsin, received more than $3,000,000. With the exception of six States—Connecticut, Delaware, Mississippi, New Hampshire, Rhode Island, and Vermont, and the Territory of Hawaii—every State received for work done during the year in excess of $1,000,000.

SUMMARY OF FEDERAL-AID ROAD WORK, BY STATES

The progress made in each of the States during the year and the results of the 15 years of Federal-aid road construction are reported in the following condensed summary for each State.

ALABAMA

The Federal-aid highway system includes 3,931 miles, of which 2,115.8 miles have been improved with Federal aid. Of the improved mileage, 83.9 miles were added during the year. At the close of the year 351.5 miles were under construction and 4.1 miles had been approved.

The mileage improved with Federal aid consists of 189.7 miles of graded and drained earth roads, 519.4 miles of untreated sand-clay, 900.9 miles of untreated gravel, 4.4 miles of treated gravel, 15 miles of treated macadam, 62.8 miles of bituminous macadam, 115.3 miles of bituminous concrete, and 298.2 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 10.1 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year was $2,768,507.17 of which the Federal share was $1,327,018.44. The disbursement of Federal funds to the State was $2,468,137.03. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $3,291,396.79.

ARIZONA

The Federal-aid highway system includes 1,979 miles, of which 841.9 miles have been improved with Federal aid. Of the improved mileage, 239.4 miles were added during the year. At the close of the year 489.3 miles were under construction and 7.5 miles had been approved.

The mileage improved with Federal aid consists of 27.1 miles of graded and drained earth roads, 38.3 miles of untreated sand-clay, 340.6 miles of untreated gravel, 280.8 miles of low-cost bituminous mixed surface, 0.5 mile of bituminous macadam, 37.8 miles of bituminous concrete, and 110.9 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 5.9 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 107.2 miles of stage construction, was $3,018,902.92, of which the Federal share was $2,209,372.79. The disbursement of Federal funds to the State was $3,034,289.82. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $92,674.36.

ARKANSAS

The Federal-aid highway system includes 4,953 miles, of which 1,737.7 miles have been improved with Federal aid. Of the improved mileage, 120.3 miles were added during the year. At the close of the year 337.7 miles were under construction and 53.6 miles had been approved.

The mileage improved with Federal aid consists of 67.2 miles of graded and drained earth roads, 949.1 miles of untreated gravel, 41.1 miles of untreated macadam, 86.5 miles of treated macadam, 266 miles of bituminous concrete and 312.2 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 15.6 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 24.6 miles of stage construction, was $4,143,719.74, of which the Federal share was $1,944,640.71. The disbursement of Federal funds to the State was $3,202,880.66. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $114,579.53.

CALIFORNIA

The Federal-aid highway system includes 4,889 miles, of which 1,928 miles have been improved with Federal aid. Of the improved mileage, 145.2 miles were added during the year. At the close of the year 396.9 miles were under construction and 60.4 miles had been approved.

The mileage improved with Federal aid consists of 397.9 miles of graded and drained earth roads, 417.8 miles of untreated gravel, 29.8 miles of untreated macadam, 133.5 miles of low-cost bituminous mixed surface, 101.2 miles of bituminous macadam, 192.9 miles of bituminous concrete, and 642.6 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 12.3 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 27.7 miles of stage construction, was $7,125,403.83, of which the Federal share was $3,188,503.15. The disbursement of Federal funds to the State was $3,726,979.36. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $926,385.10.

COLORADO

The Federal-aid highway system includes 3,584 miles, of which 1,343.3 miles have been improved with Federal aid. Of the improved mileage, 231.3 miles were added during the year. At the close of the year 295.2 miles were under construction and 37.3 miles had been approved.

The mileage improved with Federal aid consists of 177.5 miles of graded and drained earth roads, 55.9 miles of untreated sand-clay, 545.9 miles of untreated gravel, 95.6 miles of untreated macadam, 91.5 miles of low-cost bituminous mixed surface, 14.3 miles of bituminous concrete, and 344.4 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 18.2 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 37.3 miles of stage construction, was $4,589,021.87, of which the Federal share was $2,404,028.79. The disbursement of Federal funds to the State was $2,970,121.22 The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $1,968,342.74.

CONNECTICUT

The Federal-aid highway system includes 904 miles, of which 256.9 miles have been improved with Federal aid. Of the improved mileage, 15.2 miles were added during the year. At the close of the year 49 miles were under construction and 5.5 miles had been approved.

The mileage improved with Federal aid consists of 0.2 mile of untreated gravel, 17.2 miles of untreated macadam, 0.1 mile of treated macadam, 42.7 miles of bituminous macadam, 0.6 mile of bituminous concrete, and 190.7 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 5.4 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year was $1,387,635.17, of which the Federal share was $478,982.62. The disbursement of Federal funds to the State was $826,494.20. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $4,388.65.

DELAWARE

The Federal-aid highway system includes 608 miles, of which 306 miles have been improved with Federal aid. Of the improved mileage, 55.1 miles were added during the year. At the close of the year 52.6 miles were under construction and 7.4 miles had been approved.

The mileage improved with Federal aid consists of 20.2 miles of untreated gravel, 11.7 miles of low-cost bituminous mixed surface, 5.3 miles of bituminous concrete, 262 miles of Portland cement concrete, and 6.2 miles of block pavement, in addition to which there are bridges and approaches with a total length of 0.6 mile.

The total cost of all Federal-aid roads on which final payment has been made during the year was $1,739,411.96, of which the Federal share was $761,114.65. The disbursement of Federal funds to the State was $699,494.71. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $73,516.71.

FLORIDA

The Federal-aid highway system includes 1,926 miles, of which 540 miles have been improved with Federal aid. Of the improved mileage, 36.6 miles were added during the year. At the close of the year 175.5 miles were under construction and 13.3 miles had been approved.

The mileage improved with Federal aid consists of 4.4 miles of graded and drained earth roads, 15.5 miles of untreated sand-clay, 1 mile of treated gravel, 85.4 miles of untreated macadam, 72.5 miles of treated macadam, 72.6 miles of bituminous macadam, 64.3 miles of bituminous concrete, 205.5 miles of Portland cement concrete, and 10.2 miles of block pavement, in addition to which there are bridges and approaches with a total length of 8.6 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year was $1,626,884.27, of which the Federal share was $650,708.39. The disbursement of Federal funds to the State was $1,572,336.43. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $1,604,812.74.

GEORGIA

The Federal-aid highway system includes 5,557 miles, of which 2,795 miles have been improved with Federal aid. Of the improved mileage, 284.7 miles were added during the year. At the close of the year 416.9 miles were under construction and 95.9 miles had been approved.

The mileage improved with Federal aid consists of 233.7 miles of graded and drained earth roads, 1,000.9 miles of untreated sand-clay,

408 miles of untreated gravel, 3.7 miles of treated gravel, 52.3 miles of untreated macadam, 129.7 miles of treated macadam, 227.5 miles of bituminous macadam, 88.2 miles of bituminous concrete, 622.7 miles of Portland cement concrete, and 0.5 mile of block pavement, in addition to which there are bridges and approaches with a total length of 27.8 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 51.6 miles of stage construction, was $2,890,924.75, of which the Federal share was $1,311,-145.58. The disbursement of Federal funds to the State was $4,322,-392.40. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $1,049,771.28.

IDAHO

The Federal-aid highway system includes 3,116 miles, of which 1,281.9 miles have been improved with Federal aid. Of the improved mileage, 159.6 miles were added during the year. At the close of the year 304.1 miles were under construction and 114.2 miles had been approved.

The mileage improved with Federal aid consists of 197.8 miles of graded and drained earth roads, 604 miles of untreated gravel, 215.1 miles of untreated macadam, 101.4 miles of low-cost bituminous mixed surface, 20.3 miles of bituminous macadam, 89.7 miles of bituminous concrete, and 49.8 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 3.8 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 66.7 miles of stage construction, was $1,564,466.12, of which the Federal share was $899,067.70. The disbursement of Federal funds to the State was $1,660,581.47. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $395,029.73.

ILLINOIS

The Federal-aid highway system includes 6,772 miles, of which 2,267.7 miles have been improved with Federal aid. Of the improved mileage, 281.6 miles were added during the year. At the close of the year 810.4 miles were under construction and 276.6 miles had been approved.

The mileage improved with Federal aid consists of 117 miles of graded and drained earth roads, 0.4 mile of untreated gravel, 3.3 miles of bituminous macadam, 8.1 miles of bituminous concrete, 2,104.3 miles of Portland cement concrete, and 31.6 miles of block pavement, in addition to which there are bridges and approaches with a total length of 3 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 3.7 miles of stage construction, was $7,373,346.03, of which the Federal share was $3,173,832.47. The disbursement of Federal funds to the State was $5,337,535.29. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $279,005.33.

INDIANA

The Federal-aid highway system includes 4,740 miles, of which 1,579 miles have been improved with Federal aid. Of the improved mileage, 97.4 miles were added during the year. At the close of the year 281.3 miles were under construction and 129.5 miles had been approved.

The mileage improved with Federal aid consists of 16.9 miles of graded and drained earth roads, 90.2 miles of untreated gravel, 17.1 miles of bituminous macadam, 12 miles of bituminous concrete, 1,431.9 miles of Portland cement concrete, and 6.6 miles of block pavement, in addition to which there are bridges and approaches with a total length of 4.3 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year was $6,969,639.24, of which the Federal share was $3,206,979.94. The disbursement of Federal funds to the State was $1,640,813.75. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $755,222.13.

IOWA

The Federal-aid highway system includes 7,214 miles, of which 3,153.1 miles have been improved with Federal aid. Of the improved mileage, 295 miles were added during the year. At the close of the year 239.4 miles were under construction and 17.4 miles had been approved.

The mileage improved with Federal aid consists of 1,104.9 miles of graded and drained eath roads, 496.7 miles of untreated gravel, 1,527.4 miles of Portland cement concrete, and 21.9 miles of block pavement, in addition to which there are bridges and approaches with a total length of 2.2 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 219.7 miles of stage construction, was $8,440,583.54, of which the Federal share was $3,784,337.44. The disbursement of Federal funds to the State was $4,358,844.68. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $4,059.10.

KANSAS

The Federal-aid highway system includes 7,920 miles, of which 3,148.8 miles have been improved with Federal aid. Of the improved mileage, 506.3 miles were added during the year. At the close of the year 561.4 miles were under construction and 159.2 miles had been approved.

The mileage improved with Federal aid consists of 1,066.7 miles of graded and drained earth roads, 549.8 miles of untreated sand-clay, 350.5 miles of untreated gravel, 30.3 miles of treated gravel, 4.5 miles of untreated macadam, 6.8 miles of low-cost bituminous mixed surface, 129.9 miles of bituminous macadam, 2.9 miles of bituminous concrete, 825.4 miles of Portland cement concrete, and 165.6 miles of block pavement, in addition to which there are bridges and approaches with a total length of 16.4 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 165.3 miles of stage construction, was $7,507,055.66, of which the Federal share was $3,543,998.02. The disbursement of Federal funds to the State was $3,798,165.71. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $386,026.70.

KENTUCKY

The Federal-aid highway system includes 3,699 miles, of which 1,519 miles have been improved with Federal aid. Of the improved mileage, 292.8 miles were added during the year. At the close of the year 415.5 miles were under construction and 80.6 miles had been approved.

The mileage improved with Federal aid consists of 487.5 miles of graded and drained earth roads, 392.2 miles of untreated gravel, 20.5 miles of untreated macadam, 50.3 miles of treated macadam, 14.7 miles of low-cost bituminous mixed surface, 84.3 miles of bituminous macadam, 167.5 miles of bituminous concrete, 293.1 miles of Portland cement concrete, and 3.9 miles of block pavement, in addition to which there are bridges and approaches with a total length of 5 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 169.8 miles of stage construction, was $7,403,584.13, of which the Federal share was $3,181,640.29. The disbursement of Federal funds to the State was $3,197,038.96. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $183,559.55.

LOUISIANA

The Federal-aid highway system includes 2,725 miles, of which 1,418.9 miles have been improved with Federal aid. Of the improved mileage, 125.5 miles were added during the year. At the close of the year 265.2 miles were under construction and 5.7 miles had been approved.

The mileage improved with Federal aid consists of 43.2 miles of graded and drained earth roads, 1,247.2 miles of untreated gravel, 3.2 miles of bituminous macadam, 42.9 miles of bituminous concrete, and 68.5 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 13.9 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 17.4 miles of stage construction, was $2,497,574.06, of which the Federal share was $1,108,436.27. The disbursement of Federal funds to the State was $1,396,140.88. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $253,076.15.

MAINE

The Federal-aid highway system includes 1,576 miles, of which 603.2 miles have been improved with Federal aid. Of the improved mileage, 70 miles were added during the year. At the close of the

year 101 miles were under construction and 19.9 miles had been approved.

The mileage improved with Federal aid consists of 240.6 miles of untreated gravel, 56 miles of treated gravel, 181.7 miles of bituminous macadam, and 123.2 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 1.7 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 1.6 miles of reconstruction, was $2,626,753.53, of which the Federal share was $1,043,761.64. The disbursement of Federal funds to the State was $1,130,502.21. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $612,261.07.

MARYLAND

The Federal-aid highway system includes 1,828 miles, of which 707 miles have been improved with Federal aid. Of the improved mileage, 86.3 miles were added during the year. At the close of the year 52.1 miles were under construction and 17.7 miles had been approved.

The mileage improved with Federal aid consists of 4.8 miles of graded and drained earth roads, 31.5 miles of untreated gravel, 0.2 mile of untreated macadam, 3.9 miles of treated macadam, 219.6 miles of bituminous macadam, 31.5 miles of bituminous concrete, and 414.9 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 0.6 mile.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 6.7 miles of stage construction, was $2,321,767.52, of which the Federal share was $1,080,340.41. The disbursement of Federal funds to the State was $1,498,370.57. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $91,940.51.

MASSACHUSETTS

The Federal-aid highway system includes 1,437 miles, of which 724.2 miles have been improved with Federal aid. Of the improved mileage, 70.3 miles were added during the year. At the close of the year 78.9 miles were under construction and 17 miles had been approved.

The mileage improved with Federal aid consists of 0.5 mile of untreated gravel, 0.4 mile of treated gravel, 0.2 mile of untreated macadam, 2.7 miles of treated macadam, 19 miles of low-cost bituminous mixed surface, 408.8 miles of bituminous macadam, 66.5 miles of bituminous concrete, and 220.9 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 5.2 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 0.8 mile of stage construction and 2.6 miles of reconstruction, was $4,002,184.04, of which the Federal share was $1,336,894.86. The disbursement of Federal funds to the State was $1,665,230.28. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $1,597,158.35.

MICHIGAN

The Federal-aid highway system includes 5,242 miles, of which 1,804.8 miles have been improved with Federal aid. Of the improved mileage, 232.2 miles were added during the year. At the close of the year 338.3 miles were under construction and 109 miles had been approved.

The mileage improved with Federal aid consists of 22.4 miles of graded and drained earth roads, 343 miles of untreated gravel, 16.3 miles of treated macadam, 5.4 miles of bituminous macadam, 59 miles of bituminous concrete, 1,354.9 miles of Portland cement concrete, and 0.4 mile of block pavement, in addition to which there are bridges and approaches with a total length of 3.4 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 27.3 miles of stage construction, was $10,460,190.17, of which the Federal share was $4,048,668.07. The disbursement of Federal funds to the State was $2,947,103.22. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $1,973,791.60.

MINNESOTA

The Federal-aid highway system includes 6,885 miles, of which 3,987.3 miles have been improved with Federal aid. Of the improved mileage, 482.2 miles were added during the year. At the close of the year 358.8 miles were under construction and 55.2 miles had been approved.

The mileage improved with Federal aid consists of 1,017.2 miles of graded and drained earth roads, 11.1 miles of untreated sand-clay, 1,846.3 miles of untreated gravel, 17.7 miles of treated gravel, 32.7 miles of bituminous concrete, and 1,059.8 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 2.5 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 240.6 miles of stage construction, was $10,843,062.76, of which the Federal share was $4,275,605.31. The disbursement of Federal funds to the State was $3,669,096.61. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $27,432.47.

MISSISSIPPI

The Federal-aid highway system includes 3,661 miles, of which 1,772.7 miles have been improved with Federal aid. Of the improved mileage, 24.8 miles were added during the year. At the close of the year 262.5 miles were under construction and 20.8 miles had been approved.

The mileage improved with Federal aid consists of 284 miles of graded and drained earth roads, 15.7 miles of untreated sand-clay, 1,178.4 miles of untreated gravel, 11.1 miles of untreated macadam, 12.5 miles of bituminous concrete, 249.2 miles of Portland cement concrete, and 9.6 miles of block pavement, in addition to which there are bridges and approaches with a total length of 12.2 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year was $1,324,571.81, of which the

Federal share was $467,179.27. The disbursement of Federal funds to the State was $699,603.25. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $3,759,645.69.

MISSOURI

The Federal-aid highway system includes 7,530 miles, of which 2,659.5 miles have been improved with Federal aid. Of the improved mileage, 307 miles were added during the year. At the close of the year 311.8 miles were under construction and 87 miles had been approved.

The mileage improved with Federal aid consists of 365.1 miles of graded and drained earth roads, 707.4 miles of untreated gravel, 19.6 miles of untreated macadam, 33 miles of bituminous macadam, 20 miles of bituminous concrete, 1,483.7 miles of Portland cement concrete, and 19.3 miles of block pavement, in addition to which there are bridges and approaches with a total length of 11.4 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 138.2 miles of stage construction, was $11,764,495.20, of which the Federal share was $4,742,406.56. The disbursement of Federal funds to the State was $5,225,783.52. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $30,847.48.

MONTANA

The Federal-aid highway system includes 5,127 miles, of which 1,835.1 miles have been improved with Federal aid. Of the improved mileage, 272.7 miles were added during the year. At the close of the year 1,046.1 miles were under construction and 66.1 miles had been approved.

The mileage improved with Federal aid consists of 225.7 miles of graded and drained earth roads, 1,478.9 miles of untreated gravel, 72.1 miles of low-cost bituminous mixed surface, 12.5 miles of bituminous concrete, and 37 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 8.9 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 25.1 miles of stage construction, was $3,774,599.56, of which the Federal share was $2,278,439.12 The disbursement of Federal funds to the State was $3,161,355.93. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $2,120,118.98.

NEBRASKA

The Federal-aid highway system includes 5,574 miles, of which 3,848.9 miles have been improved with Federal aid. Of the improved mileage, 444 miles were added during the year. At the close of the year 445.6 miles were under construction and 128.8 miles had been approved.

The mileage improved with Federal aid consists of 396.3 miles of graded and drained earth roads, 3,163.8 miles of untreated sand-

clay, 23.3 miles of treated sand-clay, 4 miles of low-cost bituminous mixed surface, 14.6 miles of bituminous concrete, 217.4 miles of Portland cement concrete, and 19.6 miles of block pavement, in addition to which there are bridges and approaches with a total length of 9.9 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 116.2 miles of stage construction, was $2,141,382.57, of which the Federal share was $1,012,980.95. The disbursement of Federal funds to the State was $2,409,323.05. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $904,033.63.

NEVADA

The Federal-aid highway system includes 1,560 miles, of which 1,092 miles have been improved with Federal aid. Of the improved mileage, 169.4 miles were added during the year. At the close of the year 356.6 miles were under construction and 43.6 miles had been approved.

The mileage improved with Federal aid consists of 60.3 miles of graded and drained earth roads, 515.1 miles of untreated gravel, 10.8 miles of treated gravel, 445.3 miles of low-cost bituminous mixed surface, 20.6 miles of bituminous macadam, 2 miles of bituminous concrete, and 36 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 1.9 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 173.2 miles of stage construction, was $1,280,385.50, of which the Federal share was $1,117,988.62. The disbursement of Federal funds to the State was $1,393,804.29. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $204,157.11.

NEW HAMPSHIRE

The Federal-aid highway system includes 988 miles, of which 392.9 miles have been improved with Federal aid. Of the improved mileage, 42.8 miles were added during the year. At the close of the year 27.1 miles were under construction and 10.7 miles had been approved.

The mileage improved with Federal aid consists of 0.2 mile of treated gravel, 96.5 miles of untreated macadam, 82.5 miles of treated macadam, 86.1 miles of bituminous macadam, 34.3 miles of bituminous concrete, and 88.8 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 4.5 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 3.7 miles of reconstruction, was $1,688,554.45, of which the Federal share was $566,971.66. The disbursement of Federal funds to the State was $728,122.94. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $94,801.98.

NEW JERSEY

The Federal-aid highway system includes 1,315 miles, of which 555.2 miles have been improved with Federal aid. Of the improved mileage, 47.3 miles were added during the year. At the close of the year 74.7 miles were under construction and 0.2 mile had been approved.

The mileage improved with Federal aid consists of 11.9 miles of graded and drained earth roads, 6 miles of untreated gravel, 0.2 mile of treated macadam, 0.5 mile of bituminous macadam, 22.5 miles of bituminous concrete, and 511.4 miles of Portland cement concrete in addition to which there are bridges and approaches with a total length of 2.7 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year was $4,334,773.53, of which the Federal share was $1,216,111.48. The disbursement of Federal funds to the State was $1,619,943.80. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $1,177,568.27.

NEW MEXICO

The Federal-aid highway system includes 3,616 miles, of which 1,927.9 miles have been improved with Federal aid. Of the improved mileage, 171.5 miles were added during the year. At the close of the year 397 miles were under construction and 0.2 mile had been approved.

The mileage improved with Federal aid consists of 230.4 miles of graded and drained earth roads, 19.1 miles of untreated and sand-clay, 1,492.6 miles of untreated gravel, 96.1 miles of low-cost bituminous mixed surface, 0.7 mile of bituminous concrete, and 82.3 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 6.7 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 35.7 miles of stage construction, was $2,613,662.63, of which the Federal share was $1,780,453.18. The disbursement of Federal funds to the State was $3,138,928.76. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $86,785.38.

NEW YORK

The Federal-aid highway system includes 6,732 miles, of which 2,684 miles have been improved with Federal aid. Of the improved mileage, 213.5 miles were added during the year. At the close of the year 697.9 miles were under construction and 115.9 miles had been approved.

The mileage improved with Federal aid consists of 46.6 miles of graded and drained earth roads, 75.9 miles of untreated gravel, 410 miles of bituminous macadam, 15.5 miles of bituminous concrete, 2,133.3 miles of Portland cement concrete, and 0.7 mile of block pavement, in addition to which there are bridges and approaches with a total length of 2 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year was $10,125,403.76, of which the Federal

share was $3,157,104.88. The disbursement of Federal funds to the State was $3,669,032.26. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $15,421.72.

NORTH CAROLINA

The Federal-aid highway system includes 4,374 miles, of which 1,970.6 miles have been improved with Federal aid. Of the improved mileage, 241.2 miles were added during the year. At the close of the year 248.5 miles were under construction and 65.4 miles had been approved.

The mileage improved with Federal aid consists of 95.5 miles of graded and drained earth roads, 470.5 miles of untreated sand-clay, 120.3 miles of untreated gravel, 25.8 miles of untreated macadam, 35.4 miles of low-cost bituminous mixed surface, 35.7 miles of bituminous macadam, 250.8 miles of bituminous concrete, and 931.5 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 5.1 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 28.8 miles of stage construction, was $3,798,790.84, of which the Federal share was $1,797,835.64. The disbursement of Federal funds to the State was $3,366,945.86. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $1,608,127.62.

NORTH DAKOTA

The Federal-aid highway system includes 7,439 miles, of which 4,363.2 miles have been improved with Federal aid. Of the improved mileage, 883.7 miles were added during the year. At the close of the year 910.7 miles were under construction and 285.3 miles had been approved.

The mileage improved with Federal aid consists of 1,095.7 miles of graded and drained earth roads, 0.3 mile of untreated sand-clay, 3,116.2 miles of untreated gravel, 129.1 miles of treated gravel, 5.9 miles of low-cost bituminous mixed surface, 1.1 miles of bituminous concrete, and 6.6 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 8.3 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 458.2 miles of stage construction, was $2,551,573.01, of which the Federal share was $1,288,488.22. The disbursement of Federal funds to the State was $1,580,470.90. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $1,087,249.83.

OHIO

The Federal-aid highway system includes 5,899 miles, of which 2,553.6 miles have been improved with Federal aid. Of the improved mileage, 397.4 miles were added during the year. At the close of the year 252.7 miles were under construction and 119.3 miles had been approved.

The mileage improved with Federal aid consists of 118.9 miles of graded and drained earth roads, 34.2 miles of untreated gravel, 106.5 miles of untreated macadam, 26.1 miles of treated macadam, 368.3 miles of bituminous macadam, 159 miles of bituminous concrete, 1,124.9 miles of Portland cement concrete, and 607.4 miles of block pavement, in addition to which there are bridges and approaches with a total length of 8.3 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 34.4 miles of stage construction, was $16,809,335.96, of which the Federal share was $6,223,666.28. The disbursement of Federal funds to the State was $6,542,722.17. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $1,236,446.47.

OKLAHOMA

The Federal-aid highway system includes 5,769 miles, of which 1,981.3 miles have been improved with Federal aid. Of the improved mileage, 211.5 miles were added during the year. At the close of the year 416.1 miles were under construction and 52.9 miles had been approved.

The mileage improved with Federal aid consists of 380.6 miles of graded and drained earth roads, 0.7 mile of untreated sand-clay, 525.9 miles of untreated gravel, 8.3 miles of treated gravel, 28.7 miles of untreated macadam, 0.6 mile of bituminous macadam, 151 miles of bituminous concrete, 861.4 miles of Portland cement concrete, and 8.9 miles of block pavement, in addition to which there are bridges and approaches with a total length of 15.2 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 69 miles of stage construction and 2.7 miles of reconstruction, was $4,649,555.48, of which the Federal share was $2,130,091.91. The disbursement of Federal funds to the State was $4,502,041.08. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $8,011.61.

OREGON

The Federal-aid highway system includes 3,247 miles, of which 1,267.7 miles have been improved with Federal aid. Of the improved mileage, 146.5 miles were added during the year. At the close of the year 337.1 miles were under construction and 57.5 miles had been approved.

The mileage improved with Federal aid consists of 304.3 miles of graded and drained earth roads, 717 miles of untreated gravel, 13.1 miles of treated gravel, 25.6 miles of untreated macadam, 46.1 miles of bituminous macadam, 54.9 miles of bituminous concrete, and 100.5 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 6.2 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 10.6 miles of stage construction, was $1,999,595.51, of which the Federal share was $1,037,287.34. The disbursement of Federal funds to the State was

$2,873,047.97. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $442,216.97.

PENNSYLVANIA

The Federal-aid highway system includes 6,335 miles, of which 2,664.4 miles have been improved with Federal aid. Of the improved mileage, 322.5 miles were added during the year. At the close of the year 251.7 miles were under construction and 96.4 miles had been approved.

The mileage improved with Federal aid consists of 166.9 miles of graded and drained earth roads, 24.4 miles of untreated macadam, 10.6 miles of treated macadam, 7.8 miles of bituminous macadam, 98.4 miles of bituminous concrete, 2,312.6 miles of Portland cement concrete, and 40.3 miles of block pavement, in addition to which there are bridges and approaches with a total length of 3.4 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 14.1 miles of stage construction, was $30,204,188.07, of which the Federal share was $8,248,571.56. The disbursement of Federal funds to the State was $6,965,100.41. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date, was $1,151,378.69.

RHODE ISLAND

The Federal-aid highway system includes 452 miles, of which 215.4 miles have been improved with Federal aid. Of the improved mileage, 30.7 miles were added during the year. At the close of the year 42.1 miles were under construction and 0.1 mile had been approved.

The mileage improved with Federal aid consists of 1.8 miles of treated macadam, 69.7 miles of bituminous macadam, 48.1 miles of bituminous concrete, and 93.7 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 2.1 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year was $1,847,694.03, of which the Federal share was $723,239.22. The disbursement of Federal funds to the State was $950,985.01. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date, was $98,072.80.

SOUTH CAROLINA

The Federal-aid highway system includes 3,232 miles, of which 1,853.5 miles have been improved with Federal aid. Of the improved mileage, 157.4 miles were added during the year. At the close of the year 231 miles were under construction.

The mileage improved with Federal aid consists of 52.9 miles of graded and drained earth roads, 1,036.9 miles of untreated sand-clay, 101.1 miles of untreated gravel, 0.3 mile of bituminous macadam, 185 miles of bituminous concrete, and 454.4 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 22.9 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 23.5 miles of stage construction, was $3,035,805.26, of which the Federal share was $1,001,305.10. The disbursement of Federal funds to the State was $2,680,153.70. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $242,641.12.

SOUTH DAKOTA

The Federal-aid highway system includes 6,193 miles, of which 3,741.6 miles have been improved with Federal aid. Of the improved mileage, 539.6 miles were added during the year. At the close of the year 607.8 miles were under construction and 62.2 miles had been approved.

The mileage improved with Federal aid consists of 117.4 miles of graded and drained earth roads, 20.8 miles of untreated sand-clay, 15.7 miles of treated sand-clay, 3,532.5 miles of untreated gravel, 9.5 miles of low-cost bituminous mixed surface, and 41.1 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 4.6 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 187.7 miles of stage construction, was $3,726,469.50, of which the Federal share was $1,910,950.80. The disbursement of Federal funds to the State was $2,024,617.07. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $383,082.29.

TENNESSEE

The Federal-aid highway system includes 3,733 miles, of which 1,461.4 miles have been improved with Federal aid. Of the improved mileage, 266.5 miles were added during the year. At the close of the year 211.1 miles were under construction and 26 miles had been approved.

The mileage improved with Federal aid consists of 117 miles of graded and drained earth roads, 106.3 miles of untreated gravel, 61.5 miles of untreated macadam, 356.1 miles of bituminous macadam, 164.9 miles of bituminous concrete, and 647.5 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 8.1 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 61 miles of stage construction, was $6,075,905.11, of which the Federal share was $2,595,549.58. The disbursement of Federal funds to the State was $3,664,142.24. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $1,838,996.09.

TEXAS

The Federal-aid highway system includes 11,722 miles, of which 6,979.5 miles have been improved with Federal aid. Of the improved mileage, 584.4 miles were added during the year. At the

close of the year 1,182.8 miles were under construction and 138.8 miles had been approved.

The mileage improved with Federal aid consists of 725.5 miles of graded and drained earth roads, 29.3 miles of untreated sand-clay, 2,785.4 miles of untreated gravel, 309.9 miles of treated gravel, 72.7 miles of untreated macadam, 119.7 miles of treated macadam, 19.8 miles of low-cost bituminous mixed surface, 534.8 miles of bituminous macadam, 766.1 miles of bituminous concrete, 1,550.3 miles of Portland cement concrete, and 30.2 miles of block pavement, in addition to which there are bridges and approaches with a total length of 35.8 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 261.6 miles of stage construction, was $16,271,159.08, of which the Federal share was $7,143,590.29. The disbursement of Federal funds to the State was $7,366,218.34. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $3,256,872.24.

UTAH

The Federal-aid highway system includes 1,751 miles, of which 1,041.5 miles have been improved with Federal aid. Of the improved mileage, 197.1 miles were added during the year. At the close of the year 172.8 miles were under construction and 124 miles had been approved.

The mileage improved with Federal aid consists of 90.8 miles of graded and drained earth roads, 251.5 miles of untreated gravel, 3.4 miles of treated gravel, 463.3 miles of untreated macadam, 111.5 miles of low-cost bituminous mixed surface, 0.8 mile of bituminous macadam, 10.6 miles of bituminous concrete, and 106.6 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 3 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 59.8 miles of stage construction, was $898,959.29, of which the Federal share was $617,349.55. The disbursement of Federal funds to the State was $1,452,586.86. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $524,243.32.

VERMONT

The Federal-aid highway system includes 1,036 miles, of which 301.6 miles have been improved with Federal aid. Of the improved mileage, 50.7 miles were added during the year. At the close of the year 35.2 miles were under construction and 2.3 miles had been approved.

The mileage improved with Federal aid consists of 102.3 miles of untreated gravel, 2 miles of treated gravel, 1.2 miles of untreated macadam, 53.4 miles of bituminous macadam, and 136.4 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 6.3 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 1.2 miles of stage construction

and 1.4 miles of reconstruction, was $2,007,419.18, of which the Federal share was $740,678.27. The disbursement of Federal funds to the State was $750,693.40. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $52,345.06.

VIRGINIA

The Federal-aid highway system includes 3,650 miles, of which 1,624.7 miles have been improved with Federal aid. Of the improved mileage, 202.6 miles were added during the year. At the close of the year, 307.1 miles were under construction and 19 miles had been approved.

The mileage improved with Federal aid consists of 140.9 miles of graded and drained earth roads, 253.4 miles of untreated sand-clay, 95.5 miles of untreated gravel, 203 miles of untreated macadam, 5.7 miles of treated macadam, 383.1 miles of bituminous macadam, 40.6 miles of bituminous concrete, and 493.2 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 9.3 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 12 miles of stage construction, was $4,264,542.94, of which the Federal share was $1,897,292.76. The disbursement of Federal funds to the State was $2,883,737.89. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $578,394.71.

WASHINGTON

The Federal-aid highway system includes 3,033 miles, of which 1,001.4 miles have been improved with Federal aid. Of the improved mileage, 93.6 miles were added during the year. At the close of the year 202.5 miles were under construction and 29.8 miles had been approved.

The mileage improved with Federal aid consists of 193.5 miles of graded and drained earth roads, 456.7 miles of untreated gravel, and 345.6 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 5.6 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 10.4 miles of stage construction, was $3,665,180.85, of which the Federal share was $1,522,825.01. The disbursement of Federal funds to the State was $2,002,370.88. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $893,899.52.

WEST VIRGINIA

The Federal-aid highway system includes 2,216 miles, of which 772.6 miles have been improved with Federal aid. Of the improved mileage, 83.3 miles were added during the year. At the close of the year 142.4 miles were under construction and 22 miles had been approved.

The mileage improved with Federal aid consists of 243.1 miles of graded and drained earth roads, 30.6 miles of untreated gravel, 19.5

miles of untreated macadam, 0.6 mile of treated macadam, 181.4 miles of bituminous macadam, 28.2 miles of bituminous concrete, 256.4 miles of Portland cement concrete, and 10.6 miles of block pavement, in addition to which there are bridges and approaches with a total length of 2.2 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 45.4 miles of stage construction, was $3,823,054.57, of which the Federal share was $1,536,418.05. The disbursement of Federal funds to the State was $1,039,698.29. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $334,335.98.

WISCONSIN

The Federal-aid highway system includes 5,493 miles, of which 2,414.8 miles have been improved with Federal aid. Of the improved mileage, 263.4 miles were added during the year. At the close of the year 303.4 miles were under construction and 66.5 miles had been approved.

The mileage improved with Federal aid consists of 162.3 miles of graded and drained earth roads, 23.5 miles of untreated sand-clay, 977.4 miles of untreated gravel, 19.9 miles of treated gravel, 13.7 miles of bituminous macadam, 0.5 mile of bituminous concrete, and 1,208.5 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 9 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 60.2 miles of stage construction, was $8,206,234.14, of which the Federal share was $3,628,159.37. The disbursement of Federal funds to the State was $3,778,494.29. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $82,080.01.

WYOMING

The Federal-aid highway system includes 3,498 miles, of which 1,629 miles have been improved with Federal aid. Of the improved mileage, 182.2 miles were added during the year. At the close of the year 593.4 miles were under construction and 54.6 miles had been approved.

The mileage improved with Federal aid consists of 444.7 miles of graded and drained earth roads, 10.2 miles of untreated sand-clay, 1,013 miles of untreated gravel, 114.8 miles of low-cost bituminous mixed surface, 22.1 miles of bituminous concrete, and 17.2 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 7 miles.

The total cost of all Federal-aid roads on which final payment has been made during the year, including 89.8 miles of stage construction, was $881,389.43, of which the Federal share was $564,881.76. The disbursement of Federal funds to the State was $1,450,238.37. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $162,707.71.

HAWAII

The Federal-aid highway system includes 217 miles, of which 47.6 miles have been improved with Federal aid. Of the improved mileage, 6.3 miles were added during the year. At the close of the year 41.1 miles were under construction and 1.5 miles had been approved.

The mileage improved with Federal aid consists of 1.7 miles of graded and drained earth roads, 13 miles of bituminous macadam, 13.3 miles of bituminous concrete, and 19 miles of Portland cement concrete, in addition to which there are bridges and approaches with a total length of 0.6 mile.

The total cost of all Federal-aid roads on which final payment has been made during the year was $23,114.35, of which the Federal share was $11,557.17. The disbursement of Federal funds to the State was $298,198.65. The unobligated balance available on June 30, 1931, of all appropriations authorized and apportioned up to that date was $1,579,975.17.

FEDERAL-AID STATISTICS

Statistical information relative to the apportionment, obligation, and disbursement of Federal aid during the fiscal year 1931, the cost of roads completed and the estimated cost of roads under construction, and the type of the roads completed and under construction, etc., is given in Tables 17 to 32, inclusive.

TABLE 17.—*Mileage of the designated Federal-aid highway system in each State and mileage improved with Federal aid to June 30, 1931*

State	Mileage of designated Federal-aid highway system	Mileage completed with Federal aid to June 30, 1931	State	Mileage of designated Federal-aid highway system	Mileage completed with Federal aid to June 30, 1931
Alabama	3,931	2,115.8	New Hampshire	988	392.9
Arizona	1,979	841.9	New Jersey	1,315	555.2
Arkansas	4,953	1,737.7	New Mexico	3,616	1,927.9
California	4,889	1,928.0	New York	6,732	2,684.0
Colorado	3,584	1,343.3	North Carolina	4,374	1,970.6
Connecticut	904	256.9	North Dakota	7,439	4,363.2
Delaware	608	306.0	Ohio	5,899	2,553.6
Florida	1,926	540.0	Oklahoma	5,769	1,981.3
Georgia	5,557	2,795.0	Oregon	3,247	1,267.7
Idaho	3,116	1,281.9	Pennsylvania	6,335	2,664.4
Illinois	6,772	2,267.7	Rhode Island	452	215.4
Indiana	4,740	1,579.0	South Carolina	3,232	1,853.5
Iowa	7,214	3,153.1	South Dakota	6,193	3,741.6
Kansas	7,920	3,148.8	Tennessee	3,733	1,461.4
Kentucky	3,699	1,519.0	Texas	11,722	6,979.5
Louisiana	2,725	1,418.9	Utah	1,751	1,041.5
Maine	1,576	603.2	Vermont	1,036	301.6
Maryland	1,828	707.0	Virginia	3,650	1,624.7
Massachusetts	1,437	724.2	Washington	3,033	1,001.4
Michigan	5,242	1,804.8	West Virginia	2,216	772.6
Minnesota	6,885	3,987.3	Wisconsin	5,493	2,414.8
Mississippi	3,661	1,772.7	Wyoming	3,498	1,629.0
Missouri	7,530	2,659.5	Hawaii	217	47.6
Montana	5,127	1,835.1			
Nebraska	5,574	3,848.9	Total	196,877	88,713.1
Nevada	1,560	1,092.0			

TABLE 18.—*Total cost, Federal aid and mileage, of Federal-aid roads, initial and stage construction and reconstruction completed and paid for during the fiscal year 1931*

State	Total cost	Federal aid	Mileage			
			Initial	Stage	Reconstruction	Total
Alabama	$2,768,507.17	$1,327,018.44	147.5			147.5
Arizona	3,018,902.92	2,209,372.79	128.9	107.2		236.1
Arkansas	4,143,719.74	1,944,640.71	85.1	24.6		109.7
California	7,125,403.83	3,188,503.15	159.9	27.7		187.6
Colorado	4,589,021.87	2,404,028.79	195.7	37.3		233.0
Connecticut	1,387,635.17	478,982.62	27.6			27.6
Delaware	1,739,411.96	761,114.65	61.4			61.4
Florida	1,626,884.27	650,708.39	35.8			35.8
Georgia	2,890,924.75	1,311,145.58	80.2	51.6		131.8
Idaho	1,564,466.12	899,067.70	101.7	66.7		168.4
Illinois	7,373,346.03	3,173,832.47	221.5	3.7		225.2
Indiana	6,969,639.24	3,206,979.94	222.3			222.3
Iowa	8,440,583.54	3,784,337.44	93.7	219.7		313.4
Kansas	7,507,055.66	3,543,998.02	442.4	165.3		607.7
Kentucky	7,403,584.13	3,181,640.29	222.1	169.8		391.9
Louisiana	2,497,574.06	1,108,436.27	100.0	17.4		117.4
Maine	2,626,753.53	1,043,761,64	76.1		1.6	77.7
Maryland	2,321,767.52	1,080,340.41	74.8	6.7		81.5
Massachusetts	4,002,184.04	1,336,894.86	79.9	.8	2.6	83.3
Michigan	10,460,190.17	4,048,668.07	217.1	27.3		244.4
Minnesota	10,843,062.76	4,275,605.31	241.5	240.6		482.1
Mississippi	1.324,571.81	467,179.27	30.0			30.0
Missouri	11,764,495.20	4,742,406.56	222.7	138.2		360.9
Montana	3,774,599.56	2,278,439.12	229.2	25.1		254.3
Nebraska	2,141,382.57	1,012,980.95	118.1	116.2		234.3
Nevada	1,280,385.50	1,117,988.62	74.5	173.2		247.7
New Hampshire	1,688,554.45	566,971.66	34.0		3.7	37.7
New Jersey	4,334,773.53	1,216,111.48	58.6			58.6
New Mexico	2,613,662.63	1,780,453.18	134.8	35.7		170.5
New York	10,125,403.76	3,157,104.88	217.5			217.5
North Carolina	3,798,790.84	1,797,835.64	194.5	28.8		223.3
North Dakota	2,551,573.01	1,288,488.22	464.5	458.2		922.7
Ohio	16,809,335.96	6,223,666.28	377.0	34.4		411.4
Oklahoma	4,649,555.48	2,130,091.91	144.9	69.0	2.7	216.6
Oregon	1,999,595.51	1,037,287.34	150.2	10.6		160.8
Pennsylvania	30,204,188.07	8,248,571.56	498.2	14.1		512.3
Rhode Island	1,847,694.03	723,239.22	34.9			34.9
South Carolina	3,035,805.26	1,001,305.10	84.4	23.5		107.9
South Dakota	3,726,469.50	1,910,950.80	335.6	187.7		523.3
Tennessee	6,075,905.11	2,595,549.58	208.3	61.0		269.3
Texas	16,271,159.08	7,143,590.29	531.1	261.6		792.7
Utah	898,959.29	617,349.55	37.2	59.8		97.0
Vermont	2,007,419.18	740,678.27	40.0	1.2	1.4	42.6
Virginia	4,264,542.94	1,897,292.76	199.5	12.0		211.5
Washington	3,665,180.85	1,522,825.01	119.1	10.4		129.5
West Virginia	3,823,054.57	1,536,418.05	70.7	45.4		116.1
Wisconsin	8,206,234.14	3,628,159.37	257.3	60.2		317.5
Wyoming	881,389.43	564,881.76	56.6	89.8		146.4
Hawaii	23,114.35	11,557.17	.2			.2
Total	255,088,414.09	105,918,451.14	7,938.8	3,082.5	12.0	11,033.3

TABLE 19.—*Total cost, Federal aid and mileage, of Federal-aid roads, initial and stage construction and reconstruction completed, but final payment not made, as of June 30, 1931*

State	Estimated total cost	Federal aid allotted	Mileage			
			Initial	Stage	Reconstruction	Total
Alabama	$1,195,281,39	$595,171.57	29.0	26.1		55.1
Arizona	1,183,305.96	862,350.59	40.2	42.7		82.9
Arkansas	3,683,706.29	1,782,496.58	82.3	37.0		119.3
California	1,335,414.23	641,815.88	34.1	1.8		35.9
Colorado	1,029,963.21	527,588.61	30.0	6.3		36.3
Connecticut	1,072,403.38	521,200.63	1.6			1.6
Florida	1,640,582.91	756,810.96	31.5	5.5		37.0
Georgia	3,826,478.51	1,877,964.27	103.3	63.9		167.2
Idaho	224,089.40	135,173.97	15.2			15.2
Illinois	2,998,506.82	1,368,817.20	81.0	25.2		106.2
Indiana	2,195,778.21	1,064,461.20	68.9			68.9
Kansas	876,442.04	412,859.62	67.8			67.8
Kentucky	1,437,803.29	619,173.07	35.7	28.7		64.4

TABLE 19.—*Total cost, Federal aid and mileage, of Federal-aid roads, initial and stage construction and reconstruction completed, but final payment not made, as of June 30, 1931*—Continued

State	Estimated total cost	Federal aid allotted	Mileage			
			Initial	Stage	Reconstruction	Total
Louisiana	$2,543,880.29	$1,298,637.03	49.3			49.3
Maine	242,168.53	117,632.15	7.1			7.1
Maryland	642,561.97	312,286.50	2.6		11.7	14.3
Massachusetts	2,676,897.23	702,264.97	34.4			34.4
Michigan	1,341,344.99	587,198.00	32.5			32.5
Minnesota	27,775.99					
Mississippi	85,915.16	42,957.57	5.4			5.4
Missouri	2,102,328.51	770,571.37	27.7	26.3		54.0
Montana	782,798.04	438,845.29	56.1	7.8		63.9
Nebraska	5,768,736.24	2,674,861.77	226.0	127.4		353.4
Nevada	370,009.47	328,753.35		44.1		44.1
New Hampshire	269,454.44	110,709.88	7.3			7.3
New Mexico	1,495,199.18	945,982.25	75.9	16.9		92.8
New York	4,868,931.43	1,148,325.00	75.0			75.0
North Carolina	1,365,426.37	667,402.24	43.5	11.0		54.5
North Dakota	747,024.13	373,512.00	103.6	83.6		187.2
Ohio	2,839,740.36	1,033,556.28	56.5	8.7		65.2
Oklahoma	3,028,276.50	1,466,175.42	124.4	24.5	5.8	154.7
Oregon	961,790.72	617,221.68	56.4	13.3		69.7
Pennsylvania	3,381,740.73	1,090,430.17	43.1			43.1
Rhode Island	479,395.02	223,002.97	6.0			6.0
South Carolina	3,619,240.53	1,433,961.58	43.3	90.5		133.8
South Dakota	556,770.15	305,711.30	61.1	17.1		78.2
Tennessee	1,271,410.06	563,036.51	34.8	17.6		52.4
Texas	4,024,400.94	1,695,824.67	140.6	71.4		212.0
Utah	930,521.47	646,704.16	60.0	48.9		108.9
Vermont	411,964.11	153,064.08	8.8			8.8
Virginia	1,782,837.22	851,935.15	80.2	5.2		85.4
West Virginia	746,011.04	247,943.30	16.2	6.7		22.9
Wisconsin	20,805.43	10,398.00	.3			.3
Wyoming	433,754.24	274,762.93	27.0	23.2		50.2
Hawaii	329,748.81	130,498.88	6.2			6.2
Total	72,848,614.94	32,430,050.60	2,131.9	881.4	17.5	3,030.8

TABLE 20.—*Total cost, Federal aid and mileage, of Federal-aid roads, initial and stage and reconstruction improvement, under construction on June 30, 1931, by States*

State	Estimated total cost	Federal aid allotted	Mileage			
			Initial	Stage	Reconstruction	Total
Alabama	$7,537,014.55	$3,671,288.23	236.7	114.8		351.5
Arizona	6,419,231.92	4,295,941.88	260.0	229.3		489.3
Arkansas	9,139,166.13	4,354,305.88	235.6	102.1		337.7
California	12,395,686.82	5,206,186.73	293.4	103.5		396.9
Colorado	5,781,305.19	3,115,215.63	206.2	89.0		295.2
Connecticut	4,952,568.48	1,794,286.20	49.0			49.0
Delaware	1,041,247.28	519,869.13	52.6			52.6
Florida	6,424,859.85	3,007,205.42	175.5			175.5
Georgia	9,004,537.69	4,302,305.86	303.1	113.8		416.9
Idaho	4,085,734.91	2,297,771.02	271.2	32.9		304.1
Illinois	25,622,268.77	11,785,892.09	769.3	41.1		810.4
Indiana	9,209,958.89	4,536,328.72	281.3			281.3
Iowa	7,386,346.86	3,144,075.10	167.3	72.1		239.4
Kansas	8,883,373.59	4,247,356.40	505.6	55.8		561.4
Kentucky	7,439,643.91	3,259,483.02	284.4	131.1		415.5
Louisiana	8,422,172.79	4,005,813.00	245.9	19.3		265.2
Maine	4,337,397.40	1,642,395.30	101.0			101.0
Maryland	1,652,189.40	759,448.81	47.9	2.4	1.8	52.1
Massachusetts	9,210,169.31	2,276,626.32	78.9			78.9
Michigan	10,793,690.64	4,466,907.21	314.4	7.8	16.1	338.3
Minnesota	7,643,473.34	3,237,288.25	74.3	284.5		358.8
Mississippi	4,089,403.10	2,013,896.18	182.0	80.5		262.5
Missouri	9,829,670.52	3,905,276.93	246.8	65.0		311.8
Montana	11,719,226.48	6,597,231.21	888.2	157.9		1,046.1
Nebraska	9,110,895.80	4,268,494.24	245.9	199.7		445.6
Nevada	2,946,231.13	1,983,134.43	108.0	239.4	9.2	356.6
New Hampshire	1,343,033.46	515,208.60	26.1	1.0		27.1
New Jersey	6,209,545.44	1,794,968.33	74.7			74.7
New Mexico	6,820,755.52	4,117,269.64	251.5	145.5		397.0
New York	39,415,270.33	13,701,573.50	690.9	7.0		697.9
North Carolina	6,565,115.87	3,126,179.57	213.1	35.4		248.5
North Dakota	4,377,946.70	2,233,117.38	453.3	457.4		910.7

TABLE 20.—*Total cost, Federal aid and milcage, of Federal-aid roads, initial and stage and reconstruction improvement, under construction on June 30, 1931, by States*—Continued

State	Estimate total cost	Federal aid allotted	Mileage			
			Initial	Stage	Reconstruction	Total
Ohio	$15,298,336.93	$4,780,217.25	231.1	21.6		252.7
Oklahoma	7,764,820.32	3,678,809.67	298.4	109.3	8.4	416.1
Oregon	7,564,517.07	4,175,255.21	246.8	90.3		337.1
Pennsylvania	12,715,867.36	5,194,853.56	251.7			251.7
Rhode Island	2,621,715.53	976,610.80	42.1			42.1
South Carolina	5,423,297.93	2,457,109.74	78.2	152.8		231.0
South Dakota	6,206,502.83	3,334,679.87	419.4	188.4		607.8
Tennessee	4,542,803.15	2,237,133.62	193.7	17.4		211.1
Texas	20,038,372.56	9,178,199.78	858.4	324.4		1,182.8
Utah	2,204,486.97	1,284,752.41	133.9	38.9		172.8
Vermont	1,291,829.51	529,907.38	30.5	4.7		35.2
Virginia	6,193,760.18	2,810,606.22	260.9	46.2		307.1
Washington	5,833,992.87	2,590,959.02	175.7	26.8		202.5
West Virginia	5,156,102.15	2,037,767.87	129.9	12.5		142.4
Wisconsin	8,618,261.82	3,763,295.04	228.9	74.5		303.4
Wyoming	4,684,178.27	2,794,003.06	351.0	242.4		593.4
Hawaii	1,429,014.40	580,743.37	41.1			41.1
Total	387,396,991.92	172,587,244.08	12,305.8	4,138.5	35.5	16,479.8

TABLE 21.—*Total cost, Federal aid and mileage, of Federal-aid roads, initial and stage improvement, approved for construction, as of June 30, 1931, by States*

State	Estimated total cost	Federal aid allotted	Mileage		
			Initial	Stage	Total
Alabama	$93,312.53	$46,656.26	1.4	2.7	4.1
Arizona	84,143.72	54,813.77	2.4	5.1	7.5
Arkansas	1,491,745.71	713,622.89	23.7	29.9	53.6
California	1,804,148.84	663,854.92	60.4		60.4
Colorado	328,975.27	184,752.46	15.9	21.4	37.3
Connecticut	377,652.56	176,946.82	5.5		5.5
Delaware	180,024.00	90,012.00	7.4		7.4
Florida	102,816.84	51,408.41	13.3		13.3
Georgia	1,555,393.35	730,085.16	77.7	18.2	95.9
Idaho	987,824.36	574,435.01	58.3	55.9	114.2
Illinois	8,257,424.68	3,778,078.65	271.9	4.7	276.6
Indiana	3,030,777.18	1,453,338.00	129.5		129.5
Iowa	549,700.61	182,458.80		17.4	17.4
Kansas	1,804,249.75	868,140.63	113.0	46.2	159.2
Kentucky	880,912.21	428,092.95	60.8	19.8	80.6
Louisiana	120,355.82	58,515.39	5.1	.6	5.7
Maine	1,084,671.79	470,583.82	19.9		19.9
Maryland	405,155.40	202,577.69	17.7		17.7
Massachusetts	1,467,104.61	563,500.20	17.0		17.0
Michigan	2,142,332.29	1,024,613.00	81.7	27.3	109.0
Minnesota	1,278,434.70	546,474.69	5.6	49.6	55.2
Mississippi	402,117.91	201,058.94	2.5	18.3	20.8
Missouri	1,979,887.13	846,926.77	61.2	25.8	87.0
Montana	438,573.99	243,222.95	36.9	29.2	66.1
Nebraska	1,653,248.55	759,179.23	54.9	68.9	123.8
Nevada	628,107.07	395,796.58	18.8	24.8	43.6
New Hampshire	465,120.12	127,744.36	3.4	7.3	10.7
New Jersey	144,716.24	3,420.00	.2		.2
New Mexico	107,277.63	67,700.35	.2		.2
New York	6,191,200.00	2,428,525.00	115.9		115.9
North Carolina	1,023,035.04	503,233.00	29.0	36.4	65.4
North Dakota	877,431.89	438,715.84	90.4	194.9	285.3
Ohio	5,056,660.86	1,964,856.48	95.9	23.4	119.3
Oklahoma	1,078,316.17	579,499.44	39.0	13.9	52.9
Oregon	728,600.13	362,847.87	49.1	8.4	57.5
Pennsylvania	2,700,355.73	1,295,663.77	96.4		96.4
Rhode Island	91,465.74	45,732.86	.1		.1
South Dakota	512,582.94	254,606.69	15.1	47.1	62.2
Tennessee	380,641.70	190,320.84	26.0		26.0
Texas	2,777,023.12	1,226,795.58	87.6	51.2	138.8
Utah	819,142.92	483,403.55	31.2	92.8	124.0
Vermont	99,416.46	25,868.93	2.3		2.3
Virginia	497,760.77	246,236.51	18.4	.6	19.0
Washington	774,880.71	326,442.43	12.7	17.1	29.8
West Virginia	626,633.87	274,083.33	9.1	12.9	22.0
Wisconsin	1,690,746.84	552,719.04	48.9	17.6	66.5
Wyoming	311,033.86	155,516.00	10.7	43.9	54.6
Hawaii	82,324.99	22,869.00	1.5		1.5
Total	60,165,458.60	26,885,946.86	1,945.6	1,033.3	2,978.9

TABLE 22.—*Mileage of Federal-aid roads improved as of June 30, 1931, by types of construction, by States*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							
Alabama	189.7	519.4		900.9	4.4		15.0		62.8	115.3	298.2		10.1	2,115.8
Arizona	27.1	38.3		340.6				280.8	.5	37.8	110.9		5.9	841.9
Arkansas	67.2			949.1		41.1	86.5			266.0	312.2		15.6	1,737.7
California	397.9			417.8		29.8		133.5	101.2	192.9	642.6		12.3	1,928.0
Colorado	177.5	55.9		545.9		95.6		91.5		14.3	344.4		18.2	1,343.3
Connecticut				.2		17.2	.1		42.7	.6	190.7		5.4	256.9
Delaware				20.2				11.7		5.3	262.0	6.2	.6	306.0
Florida	4.4	15.5			1.0	85.4	72.5		72.6	64.3	205.5	10.2	8.6	540.0
Georgia	233.7	1,000.9		408.0	3.7	52.3	129.7		227.5	88.2	622.7	.5	27.8	2,795.0
Idaho	197.8			604.0		215.1		101.4	20.3	89.7	49.8		3.8	1,281.9
Illinois	117.0			.4					3.3	8.1	2,104.3	31.6	3.0	2,267.7
Indiana	16.9			90.2					17.1	12.0	1,431.9	6.6	4.3	1,579.0
Iowa	1,104.9			496.7							1,527.4	21.9	2.2	3,153.1
Kansas	1,066.7	549.8		350.5	30.3	4.5		6.8	129.9	2.9	525.4	165.6	16.4	3,148.8
Kentucky	487.5			392.2		20.5	50.3	14.7	84.3	167.5	293.1	3.9	5.0	1,519.0
Louisiana	43.2			1,247.2					3.2	42.9	68.5		13.9	1,418.9
Maine				240.6	56.0				181.7		123.2		1.7	603.2
Maryland	4.8			31.5		.2	3.9		219.6	31.5	414.9		.6	707.0
Massachusetts				.5	.4	.2	2.7	19.0	408.8	66.5	220.9		5.2	724.2
Michigan	22.4			343.0			16.3		5.4	59.0	1,354.9	.4	3.4	1,804.8
Minnesota	1,017.2	11.1		1,846.3	17.7					32.7	1,059.8		2.5	3,987.3
Mississippi	284.0	15.7		1,178.4		11.1				12.5	249.2	9.6	12.2	1,772.7
Missouri	365.1			707.4		19.6			33.0	20.0	1,483.7	19.3	11.4	2,659.5
Montana	225.7			1,478.9				72.1		12.5	37.0		8.9	1,835.1
Nebraska	396.3	3,163.8	23.3					4.0		14.6	217.4	19.6	9.9	3,848.9
Nevada	60.3			515.1	10.8			445.3	20.6	2.0	36.0		1.9	1,092.0
New Hampshire					.2	96.5	82.5		86.1	34.3	88.8		4.5	392.9
New Jersey	11.9			6.0			.2		.5	22.5	511.4		2.7	555.2
New Mexico	230.4	19.1		1,492.6				96.1		.7	82.3		6.7	1,927.9
New York	46.6			75.9					10.0	15.5	2,133.3	.7	2.0	2,684.0
North Carolina	95.5	470.5		120.3		25.8		35.4	35.7	250.8	931.5		5.1	1,970.6
North Dakota	1,095.7	.3		3,116.2	129.1			5.9		1.1	6.6		8.3	4,363.2
Ohio	118.9			34.2		106.5	26.1		368.3	159.0	1,124.9	607.4	8.3	2,553.6
Oklahoma	380.6	.7		525.9	8.3	28.7			.6	151.0	861.4	8.9	15.2	1,981.3
Oregon	304.3			717.0	13.1	25.6			46.1	54.9	100.5		6.2	1,267.7
Pennsylvania	166.9					24.4	10.6		7.8	98.4	2,312.6	40.3	3.4	2,664.4
Rhode Island							1.8		69.7	48.1	93.7		2.1	215.4
South Carolina	52.9	1,036.9		101.1					.3	185.0	454.4		22.9	1,853.5
South Dakota	117.4	20.8	15.7	3,532.5				9.5			41.1		4.6	3,741.6
Tennessee	117.0			106.3		61.5			356.1	164.9	647.5		8.1	1,461.4
Texas	725.5	29.3		2,785.4	309.9	72.7	119.7	19.8	534.8	766.1	1,550.3	30.2	35.8	6,979.5

Utah	90.8			251.5	3.4	463.3		111.5	.8	10.6	106.6		3.0	1,041.5
Vermont				102.3	2.0	1.2			53.4		136.4		6.3	301.6
Virginia	140.9	253.4		95.5		203.0	5.7		383.1	40.6	493.2		9.3	1,624.7
Washington	193.5			456.7							345.6		5.6	1,001.4
West Virginia	243.1			30.6		19.5	.6		181.4	28.2	256.4	10.6	2.2	772.6
Wisconsin	162.3	23.5		977.4	19.9				13.7	.5	1,208.5		9.0	2,414.8
Wyoming	444.7	10.2		1,013.0				114.8		22.1	17.2		7.0	1,629.0
Hawaii	1.7								13.0	13.3	19.0		.6	47.6
Total	11,247.9	7,235.1	39.0	28,646.0	610.2	1,721.3	624.2	1,573.8	4,195.9	3,426.7	28,009.8	993.5	389.7	88,713.1

TABLE 23.—*Mileage of Federal-aid roads initially completed and paid for during the fiscal year 1931, by types of construction, by States*

State	Graded and drained	Sand-clay, untreated	Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
			Untreated	Treated	Untreated	Treated							
Alabama	63.3		21.3						17.0	44.5		1.4	147.5
Arizona	23.8		14.9				88.0	0.6				1.6	128.9
Arkansas	9.6		10.1						8.1	54.7		2.6	85.1
California	11.7		26.0				36.7	4.4	35.2	44.2		1.7	159.9
Colorado	2.8		134.2				25.4		1.2	28.0		4.1	195.7
Connecticut						0.1		13.9		13.4		.2	27.6
Delaware			15.4						5.3	40.7			61.4
Florida	1.9					16.1			7.1	10.1		.6	35.8
Georgia	21.5							11.5	12.7	34.1		.4	80.2
Idaho	18.3		68.1				15.1					.2	101.7
Illinois	8.7									205.8	6.2	.8	221.5
Indiana										222.0		.3	222.3
Iowa										93.7			93.7
Kansas	94.8	184.6	55.3	22.5			3.8			78.3		3.1	442.4
Kentucky	43.5		122.6		0.1		1.8		26.4	26.6		1.1	222.1
Louisiana	17.6		74.4							7.2		.8	100.0
Maine			15.0	33.8				8.7		18.6			76.1
Maryland								9.7		64.5		.6	74.8
Massachusetts								54.2	19.2	5.5		1.0	79.9
Michigan	13.7		8.3							192.6		2.5	217.1
Minnesota	169.1		20.5							51.1		.8	241.5
Mississippi	28.0											2.0	30.0
Missouri	22.1									199.6		1.0	222.7
Montana	59.6		149.3				17.7			.3		2.3	229.2
Nebraska		116.8								.9		.4	118.1
Nevada			74.5										74.5
New Hampshire				.2		6.5				26.7		.6	34.0
New Jersey			.2						.4	57.8		.2	58.6
New Mexico	29.4		69.2				27.0			7.9		1.3	134.8
New York	13.5							19.1	4.1	180.8			217.5

TABLE 23.—*Mileage of Federal-aid roads initally completed and paid for during the fiscal year 1931, by types of construction, by States*—Con.

State	Graded and drained	Sand-clay, untreated	Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
			Untreated	Treated	Untreated	Treated							
North Carolina	21.0	41.4	28.2				35.5			67.5		0.9	194.5
North Dakota	416.0		44.5	3.4			.2					.4	464.5
Ohio	15.9		21.4		0.1			15.1	2.9	235.8	82.9	2.9	377.0
Oklahoma	77.4									66.2		1.3	144.9
Oregon	105.7		28.7					3.5		10.4		1.9	150.2
Pennsylvania	42.1				24.4					421.8	8.6	1.3	498.2
Rhode Island								22.7		11.3		.9	34.9
South Carolina	14.5	15.4	1.3						1.5	51.0		.7	84.4
South Dakota	2.7		327.2							5.1		.6	335.6
Tennessee	53.6								43.3	110.9		.5	208.3
Texas	297.8		.6	12.0					17.3	196.2		7.2	531.1
Utah	6.1		25.2				5.3			.5		.1	37.2
Vermont			.8					1.8		36.7		.7	40.0
Virginia	65.7	29.6			67.9			28.8		6.3		1.2	199.5
Washington	38.9		60.2							19.3		.7	119.1
West Vrginia	4.4		3.3					14.4	5.7	42.2		.7	70.7
Wisconsin	18.4		67.0							169.5		2.4	257.3
Wyoming	21.3		34.8				.3					.2	56.6
Hawaii												.2	.2
Total	1,854.4	387.8	1,522.5	71.9	92.5	22.7	256.8	208.4	207.4	3,160.3	97.7	56.4	7,938.8

TABLE 24.—*Mileage of Federal-aid roads, initial construction, completed but final payment not made, by types of construction, by States, as of June 30, 1931*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							
Alabama											29.0			29.0
Arizona				22.6				15.4			1.7		0.5	40.2
Arkansas	5.8			27.0							46.4		3.1	82.3
California	21.0			1.7		7.3					3.7		.4	34.1
Colorado				23.3				6.0					.7	30.0
Connecticut											.3		1.3	1.6
Florida										3.6	27.5		.4	31.5

Georgia	16.0	9.7					23.6		8.7		44.6		.7	103.3
Idaho				15.1									.1	15.2
Illinois											80.9		.1	81.0
Indiana											68.9			68.9
Kansas	9.9	31.8		12.0	6.9						6.6		.6	67.8
Kentucky	10.5			9.1							15.9		.2	35.7
Louisiana				38.6							4.5		6.2	49.3
Maine				5.6	.4								1.1	7.1
Maryland											2.6			2.6
Massachusetts									18.8	2.4	12.9		.3	34.4
Michigan				13.8							18.4		.3	32.5
Mississippi	2.6										2.8			5.4
Missouri	8.7										19.0			27.7
Montana				42.6				12.9					.6	56.1
Nebraska	.2	181.0	22.5					.2			21.1		1.0	226.0
New Hampshire							1.3				6.0			7.3
New Mexico				51.5				23.6					.8	75.9
New York	6.6			2.9							65.5			75.0
North Carolina		8.6									34.7		.2	43.5
North Dakota	65.7			37.8									.1	103.6
Ohio				3.5					7.4		22.0	22.8	.8	56.5
Oklahoma	65.2									4.2	54.1		.9	124.4
Oregon	26.0				13.1				16.6				.7	56.4
Pennsylvania	15.7										26.8		.6	43.1
Rhode Island											5.7		.3	6.0
South Carolina											43.0		.3	43.3
South Dakota				61.0									.1	61.1
Tennessee	27.0										7.4		.4	34.8
Texas	92.7			7.5					6.6		32.5		1.3	140.6
Utah				59.7									.3	60.0
Vermont											8.7		.1	8.8
Virginia	8.3	23.9				29.5			4.4	.9	12.9		.3	80.2
West Virginia									7.8		8.4			16.2
Wisconsin				.1									.2	.3
Wyoming	5.8			12.4				7.5			1.2		.1	27.0
Hawaii									6.1				.1	6.2
Total	387.7	255.0	22.5	447.8	20.4	36.8	24.9	65.6	76.4	11.1	735.7	22.8	25.2	2,131.9

TABLE 25.—*Mileage of Federal-aid roads under initial construction on June 30, 1931, by types of construction, by States*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							
Alabama	125.8			1.0							107.8		2.1	236.7
Arizona	32.5			131.9				92.9					2.7	260.0
Arkansas	172.0			15.0							45.9		2.7	235.6
California	23.4			27.8	2.4	2.0		160.1	10.4	38.7	25.5		3.1	293.4
Colorado	8.2			96.0				88.0			9.2		4.8	206.2
Connecticut										.2	45.7		3.1	49.0
Delaware	4.3										48.0		.3	52.6
Florida	40.4						49.6			14.9	65.4		5.2	175.5
Georgia	80.5	1.6		7.5			101.3	14.7		11.0	85.1		1.4	303.1
Idaho	49.2			176.7				43.5					1.8	271.2
Illinois	75.3										687.2		6.8	769.3
Indiana	19.1										256.7		5.5	281.3
Iowa											167.3			167.3
Kansas	373.8	36.4	3.7	12.9	8.6			11.7			54.7		3.8	505.6
Kentucky	148.0			50.3				10.5			74.4		1.2	284.4
Louisiana	18.9			85.9							138.8		2.3	245.9
Maine					52.2				11.6		36.6		.6	101.0
Maryland				7.4					10.6	3.0	26.8		.1	47.9
Massachusetts									32.2	8.6	34.7		3.4	78.9
Michigan	89.2			32.3						12.1	179.3		1.5	314.4
Minnesota	36.4										37.9			74.3
Mississippi	145.6										33.6		2.8	182.0
Missouri	43.7			67.7							133.0		2.4	246.8
Montana	109.9			609.2				166.6		.6			1.9	888.2
Nebraska		194.4	7.0					6.9		.7	35.1		1.8	245.9
Nevada				79.5				28.5						108.0
New Hampshire					4.0					1.8	19.2		1.1	26.1
New Jersey											73.5		1.2	74.7
New Mexico	77.5			95.6				74.9					3.5	251.5
New York	46.1			4.0					57.7	77.9	505.0		.2	690.9
North Carolina	6.5	17.0		20.9				40.5		23.0	103.5		1.7	213.1
North Dakota	426.5			21.3				.3			4.7		.5	453.3
Ohio	9.0			6.1			6.3		8.2	3.9	159.8	32.9	4.9	231.1
Oklahoma	158.5			7.4							131.2		1.3	298.4
Oregon	47.1			28.8	25.5	42.3	25.4	11.5	57.8		6.8		1.6	246.8
Pennsylvania	1.4					200.7	4.9			.8	39.0	3.0	1.9	251.7
Rhode Island									23.1	.8	17.8		.4	42.1
South Carolina		27.2									50.6		.4	78.2
South Dakota	222.4			195.5									1.5	419.4
Tennessee	121.4									16.9	53.6		1.8	193.7
Texas	640.6			14.0	11.4		16.5			12.4	153.8		9.7	858.4
Utah				88.7				44.6			.1		.5	133.9

Vermont				5.6							24.5		.4	30.5
Virginia	70.9	43.5	21.1	1.9	5.4	82.6	16.1		5.3		12.8		1.3	260.9
Washington	73.3			65.4							36.4		.6	175.7
West Virginia	33.9			4.3			1.1		13.3	6.4	70.5		.4	129.9
Wisconsin	31.7			47.3							147.2		2.7	228.9
Wyoming	229.7			20.1				97.5	2.0				1.7	351.0
Hawaii	1.9								39.1				.1	41.1
Total	3,794.6	320.1	31.8	2,028.0	109.5	327.6	221.2	892.7	271.3	233.7	3,938.7	35.9	100.7	12,305.8

TABLE 26.—*Mileage of Federal-aid roads approved for initial construction on June 30, 1931, by types of construction, by States*

State	Graded and drained	Sand-clay, untreated	Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
			Untreated	Treated	Untreated	Treated							
Alabama										1.4			1.4
Arizona			2.4										2.4
Arkansas	8.1									15.0		0.6	23.7
California				7.3			12.3	1.0	23.1	16.1		.6	60.4
Colorado			8.3				7.5					.1	15.9
Connecticut										5.2		.3	5.5
Delaware										7.4			7.4
Florida	13.3												13.3
Georgia	28.7	6.4				12.3			18.7	11.3		.3	77.7
Idaho	4.5		53.6									.2	58.3
Illinois	60.2									209.7		2.0	271.9
Indiana	4.0						30.2			94.8		.5	129.5
Kansas	34.5	7.7		9.0			37.3			24.3		.2	113.0
Kentucky	49.2									11.0		.6	60.8
Louisiana			.4							4.7			5.1
Maine				14.9				1.7		2.4		.9	19.9
Maryland								12.2		5.5			17.7
Massachusetts								12.1		4.4		.5	17.0
Michigan	32.3									49.3		.1	81.7
Minnesota	.5									5.1			5.6
Mississippi	2.4											.1	2.5
Missouri	12.4		6.9					4.4		37.4		.1	61.2
Montana	2.0		34.8									.1	36.9
Nebraska		33.4					8.0			12.6		.9	54.9
Nevada			17.5				1.3						18.8
New Hampshire										3.4			3.4
New Jersey										.2			.2
New Mexico												.2	.2
New York	12.2		6.2						17.0	80.5			115.9
North Carolina	3.9		5.5				14.0			5.3		.3	29.0

TABLE 26.—*Mileage of Federal-aid roads approved for initial construction on June 30, 1921, by types of construction, by States*—Continued

State	Graded and drained	Sand-clay, untreated	Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
			Untreated	Treated	Untreated	Treated							
North Dakota	88.7		1.6									.1	90.4
Ohio			3.3					15.9	17.6	48.2	9.1	1.8	95.9
Oklahoma	16.3									22.7			39.0
Oregon	14.1		21.6			13.3						.1	49.1
Pennsylvania					82.1					14.2		.1	96.4
Rhode Island												.1	.1
South Dakota	15.1												15.1
Tennessee	25.8											.2	26.0
Texas	68.0								.9	16.8		1.9	87.6
Utah			20.3						3.3	7.5		.1	31.2
Vermont			.1							2.1		.1	2.3
Virginia	4.8	3.2			10.0							.4	18.4
Washington			3.9							8.8			12.7
West Virginia										8.9		.2	9.1
Wisconsin	21.0		8.1							18.2		1.6	48.9
Wyoming	10.7												10.7
Hawaii								1.5					1.5
Total	532.7	50.7	194.5	31.2	92.1	256.	110.6	48.8	80.6	754.4	9.1	15.3	1,945.6

TABLE 27.—*Mileage of Federal-aid-road stage construction completed and paid for during the fiscal year 1931, by types of construction, by States*

State	Graded and drained	Sand-clay, untreated	Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
			Untreated	Treated	Untreated	Treated							
Arizona							106.8					0.4	107.2
Arkansas										24.5		.1	24.6
California	9.2		2.3							16.0		.2	27.7
Colorado			6.4				19.9			10.4		.6	37.3
Georgia			7.7			5.6			4.7	33.5		.1	51.6
Idaho			3.7				57.7			5.3			66.7
Illinois										3.7			3.7
Iowa										219.7			219.7
Kansas	.1	66.5	53.9	1.0			3.0			40.5		.3	165.3
Kentucky			59.9				2.6		34.5	72.6		.2	169.8
Louisiana										17.3		.1	17.4
Maryland	1.0									5.7			6.7
Massachusetts												.8	.8
Michigan										27.3			27.3
Minnesota	11.3								.1	229.1		.1	240.6
Missouri										138.1		.1	138.2
Montana							24.8					.3	25.1
Nebraska		81.1								35.1			116.2
Nevada							173.0					.2	173.2
New Mexico			6.3				29.4						35.7
North Carolina		2.9	6.9		6.2				3.1	9.6		.1	28.8
North Dakota			407.0	45.5			5.7						458.2
Ohio										25.2	8.5	.7	34.4
Oklahoma									7.9	61.1			69.0
Oregon			6.6					4.0					10.6
Pennsylvania										14.1			14.1
South Carolina									22.2	1.3			23.5
South Dakota	.2		158.5							28.8		.2	187.7
Tennessee										60.9		.1	61.0
Texas	19.4			7.6				13.1	17.5	203.6		.4	261.6
Utah							59.5			.3			59.8
Vermont												1.2	1.2
Virginia					.8			3.7		6.4		1.1	12.0
Washington			10.4										10.4
West Virginia					15.3					30.1			45.4
Wisconsin										60.2			60.2
Wyoming	.8		41.9				46.9					.2	89.8
Total	42.0	150.5	771.5	54.1	22.3	5.6	529.3	20.8	90.0	1,380.4	8.5	7.5	3,082.5

TABLE 28.—*Mileage of Federal-aid roads, stage construction, completed but final payment not made, by types of construction, by States, as of June 30, 1931*

State	Graded and drained	Sand-clay, untreated	Gravel, untreated	Macadam, treated	Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Bridges and approaches	Total
Alabama							10.9	15.0	0.2	26.1
Arizona					42.5				.2	42.7
Arkansas								37.0		37.0
California	1.7								.1	1.8
Colorado					6.3					6.3
Florida				5.4					.1	5.5
Georgia				11.9			16.5	35.5		63.9
Illinois								25.2		25.2
Kentucky					10.3			18.4		28.7
Missouri								26.2	.1	26.3
Montana					7.8					7.8
Nebraska	.3	53.6						72.9	.6	127.4
Nevada					44.1					44.1
New Mexico					15.9				1.0	16.9
North Carolina			7.3				1.2	2.5		11.0
North Dakota	8.3		75.3							83.6
Ohio								8.6	.1	8.7
Oklahoma								24.5		24.5
Oregon	2.0					11.3				13.3
South Carolina							5.6	84.8	.1	90.5
South Dakota			17.1							17.1
Tennessee								17.6		17.6
Texas							43.5	27.5	.4	71.4
Utah			41.4		7.5					48.9
Virginia	.5		.5			4.1			.1	5.2
West Virginia								6.7		6.7
Wyoming			13.7		9.5					23.2
Total	12.8	53.6	155.3	17.3	143.9	15.4	77.7	402.4	3.0	881.4

TABLE 29.—*Milage of Federal-aid roads under stage construction on June 30, 1931, by types of construction, by States*

State	Graded and drained	Sand-clay, untreated	Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
			Untreated	Treated	Untreated	Treated							
Alabama	2.9		0.5						18.5	92.7		0.2	114.8
Arizona	1.7		9.4				216.3	0.3		.5		1.1	229.3
Arkansas	19.3									82.6		.2	102.1
California	7.0			12.7			38.7		22.5	20.8		1.8	103.5
Colorado			.3				59.1			29.4		.2	89.0
Georgia						34.9				76.1	2.5	.3	113.8
Idaho	1.3		3.5				28.1						32.9
Illinois										41.0		.1	41.1
Iowa										72.1			72.1
Kansas	11.6			8.6			15.6			19.3		.7	55.8
Kentucky			26.1				22.7		20.0	61.9		.4	131.1
Louisiana	2.0									17.2		.1	19.3
Maryland										2.4			2.4
Michigan										7.7		.1	7.8
Minnesota	99.0									185.3		.2	284.5
Mississippi	41.7									38.6		.2	80.5
Missouri	10.4									54.4		.2	65.0
Montana			60.2				97.6					.1	157.9
Nebraska		45.3								153.3		1.1	199.7
Nevada			7.4				229.6					2.4	239.4
New Hampshire										1.0			1.0
New Mexico	3.8		54.9				84.3			1.7		.8	145.5
New York									7.0				7.0
North Carolina	13.2								11.5	10.7			35.4
North Dakota	62.3		294.9				93.2			6.9		.1	457.4
Ohio								.2		19.7	.4	1.3	21.6
Oklahoma	13.8		5.7							89.7		.1	109.3
Oregon	11.9		5.5		1.2	3.4		61.7	6.1	.4		.1	90.3
South Carolina										152.3		.5	152.8
South Dakota	46.3		58.2	9.8			19.6			54.2		.3	188.4
Tennessee	5.5								4.0	7.9			17.4
Texas	44.2			41.8	10.7	31.4			29.7	165.8		.8	324.4
Utah	15.9		7.8				14.0			1.1		.1	38.9
Vermont								4.7					4.7
Virginia		7.9			8.8	5.7				23.5		.3	46.2
Washington			10.7							16.1			26.8
West Virginia	7.4							1.8		3.3			12.5
Wisconsin	1.4		1.2							71.6		.3	74.5
Wyoming	1.0		57.1				184.2					.1	242.4
Total	423.6	53.2	603.4	72.9	20.7	75.4	1,103.0	68.7	119.3	1,581.2	2.9	14.2	4,138.5

TABLE 30.—*Mileage of Federal-aid roads approved for stage construction on June 30, 1931, by types of construction, by States*

State	Graded and drained	Sand-clay		Gravel		Macadam, treated	Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated								
Alabama										2.7			2.7
Arizona							5.1						5.1
Arkansas	0.7									28.9		0.3	29.9
Colorado							21.3					.1	21.4
Georgia						9.7				8.5			18.2
Idaho				2.6			53.3						55.9
Illinois										4.7			4.7
Iowa										17.4			17.4
Kansas	1.0	10.3			21.8					12.9		.2	46.2
Kentucky				13.7					1.7	4.4			19.8
Louisiana										.6			.6
Michigan									19.0	8.3			27.3
Minnesota	7.0									42.6			49.6
Mississippi	.7									17.6			18.3
Missouri										25.7		.1	25.8
Montana				11.5			17.7						29.2
Nebraska		46.9								21.5		.5	68.9
Nevada				10.6			13.6					.6	24.8
New Hampshire										7.3			7.3
North Carolina			4.0	.3			16.2		6.0	9.9			36.4
North Dakota				183.3			11.6						194.9
Ohio								0.9		13.6	8.1	.8	23.4
Oklahoma				6.9						6.8		.2	13.9
Oregon								6.6		1.8			8.4
South Dakota	11.6				27.7					7.8			47.1
Texas	13.2					11.1				26.6		.3	51.2
Utah							92.3			.5			92.8
Virginia										.6			.6
Washington										17.1			17.1
West Virginia										12.9			12.9
Wisconsin	5.0									12.2		.4	17.6
Wyoming				17.9			26.0						43.9
Total	39.2	57.2	4.0	246.8	49.5	20.8	257.1	7.5	26.7	312.9	8.1	3.5	1,033.3

TABLE 31.—*Net changes in the types of Federal-aid improvements on the Federal-aid highway system during the fiscal year 1931*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							
Alabama	−70.0	−3.8		−39.2			−5.8			11.0	69.6		0.2	−38.0
Arizona	−53.1	−20.5		−121.4				225.0	0.5	−.3	1.6		−.2	31.6
Arkansas	−19.1			−80.3	−6.4	−0.4	−24.1			8.1	114.8		3.7	−3.7
California	15.4			−50.9		7.3			4.4	18.2	51.8		1.7	47.9
Colorado	−23.0	−11.2		87.2		−5.6		43.8		1.2	38.3		4.5	135.2
Connecticut									3.0		9.1		1.4	13.5
Delaware				9.0						5.3	40.7			55.0
Florida	−10.5						5.5			3.6	37.5		.5	36.6
Georgia	19.0	−128.5		−33.0			41.2		20.2	34.0	141.2		−2.4	91.7
Idaho	17.0			21.7		−29.0		72.9			5.2		.1	87.9
Illinois	−66.9										271.5	6.2	.8	211.6
Indiana											97.1		.2	97.3
Iowa	−96.6			−24.4							294.3		.1	173.4
Kansas	−210.8	273.2		110.8	30.3			6.8		−.6	103.2	−.4	2.4	314.9
Kentucky	−194.5			2.2				14.7		52.3	113.0		1.0	−11.3
Louisiana	8.1			27.4							28.7		2.4	66.6
Maine				17.8	27.7				6.4		15.4		1.1	68.4
Maryland						.1			−5.3		80.8		.6	76.2
Massachusetts								−3.0	42.6	10.1	16.5		.6	66.8
Michigan	13.8			.3					−5.0	−10.0	199.5		1.0	199.6
Minnesota	16.6			−232.7							266.3		.9	51.1
Mississippi	−10.6			−42.2							2.9		2.0	−47.9
Missouri	−27.2			−45.4		−7.6			−10.0		263.6	−1.6	1.0	172.8
Montana	15.5			36.0				63.3					2.9	117.7
Nebraska	−108.3	136.7	22.5					.2			127.3		1.4	179.8
Nevada	13.5			−290.0	−3.5			162.8			−9.2		−.9	−127.3
New Hampshire					.2	−1.0	7.7			−1.6	34.3		.6	40.2
New Jersey	.1										47.0		.3	47.4
New Mexico	−35.3	−8.2		−14.3				78.9			−.2		2.6	23.5
New York	−.3			−.5					7.5	4.0	182.3			193.0
North Carolina	7.6	−4.1		42.3		6.2		35.4	.1	−6.1	107.5		1.1	190.0
North Dakota	−280.1	−10.5		336.4	48.5			5.9					.4	100.6
Ohio	−1.7			24.8		−4.2			11.8	2.9	241.1	84.7	3.8	363.2
Oklahoma	2.1			−33.3							120.3		1.8	90.9
Oregon	69.0			5.5	13.1				31.9	−9.3	5.8		1.3	117.3
Pennsylvania	10.0					24.4			.1		285.8	.8	1.4	322.5
Rhode Island									12.6		16.9		1.2	30.7
South Carolina	9.6	−165.1		−6.6					−2.8	−1.0	150.7		.2	−15.0
South Dakota	−87.1	−15.2		369.9							28.2		.7	296.5
Tennessee	12.3								−5.6	43.3	149.6		.9	200.5
Texas	−109.8	−10.1		−72.2	17.7				13.0	56.5	243.2		5.6	143.9

TABLE 31.—*Net changes in the types of Federal-aid improvements on the Federal-aid highway system during the fiscal year 1931*—Cont.

State	Graded and drained	Sand-clay		Gravel		Macadam		Low cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							
Utah	−20.1			104.7		−97.6		72.3			.7		.3	60.3
Vermont				−4.3					1.8		46.8		1.7	46.0
Virginia	55.9	37.1		−5.8		69.2	−3.7		9.0	.8	−8.9		3.2	156.8
Washington	14.1			36.3							15.8		.6	66.8
West Virginia	−6.5			2.3		5.3			−3.6	−.5	66.2	−.8	.1	62.5
Wisconsin	18.1	−.3		−52.8						.1	201.4		2.1	168.6
Wyoming	−86.9	−.4		−47.2				52.9			1.3		.6	−79.7
Hawaii									6.1				.3	6.4
Total	−1,200.7	69.1	22.5	38.1	127.6	−32.9	20.8	831.9	138.7	222.0	4,316.5	88.9	57.8	4,700.3

TABLE 32.—*Federal-aid apportionment, and amounts paid to the States for the fiscal year 1931, and the unobligated balance of the total apportionment on June 30, 1931*

State	Apportionment fiscal year 1931	Paid to States during the fiscal year 1931	Unobligated balances of total apportionment on June 30, 1931
Alabama	$2,595,620	$2,468,137.03	$3,291,396.79
Arizona	1,770,317	3,034,289.82	92,674.36
Arkansas	2,155,143	3,202,880.66	114,579.53
California	4,168,617	3,726,979.36	926,385.10
Colorado	2,317,540	2,970,121.22	1,968,342.74
Connecticut	796,489	826,494.20	4,388.65
Delaware	609,375	699,494.71	73,516.71
Florida	1,535,930	1,572,336.43	1,604,812.74
Georgia	3,309,387	4,322,392.40	1,049,771.28
Idaho	1,554,323	1,660,581.47	395,029.73
Illinois	5,167,968	5,337,535.29	279,005.33
Indiana	3,182,508	1,640,813.75	755,222.13
Iowa	3,343,240	4,358,844.68	4,059.10
Kansas	3,414,308	3,798,165.71	386,026.70
Kentucky	2,357,683	3,197,038.96	183,559.55
Louisiana	1,733,658	1,396,140.88	253,076.15
Maine	1,125,177	1,130,502.21	612,261.07
Maryland	1,053,185	1,498,370.57	91,940.51
Massachusetts	1,816,704	1,665,230.28	1,597,158.35
Michigan	3,666,962	2,947,103.22	1,973,791.60
Minnesota	3,504,977	3,669,096.61	27,432.47
Mississippi	2,206,495	699,603.25	3,759,645.69
Missouri	3,970,638	5,225,783.52	30,847.48
Montana	2,588,108	3,161,355.93	2,120,118.98
Nebraska	2,644,210	2,409,323.05	904,033.63
Nevada	1,601,408	1,393,804.29	204,157.11
New Hampshire	609,375	728,122.94	94,801.98
New Jersey	1,560,390	1,619,943.80	1,177,568.27
New Mexico	1,983,827	3,138,928.76	86,785.38
New York	6,009,941	3,669,032.26	15,421.72
North Carolina	2,871,122	3,366,945.86	1,608,127.62
North Dakota	2,005,100	1,580,470.90	1,087,249.83
Ohio	4,589,213	6,542,722.17	1,236,446.47
Oklahoma	2,918,358	4,502,041.08	8,011.61
Oregon	1,996,112	2,873,047.97	442,216.97
Pennsylvania	5,524,512	6,965,100.41	1,151,378.69
Rhode Island	609,375	950,985.01	98,072.80
South Carolina	1,775,175	2,680,153.70	242,641.12
South Dakota	2,054,937	2,024,617.07	383,082.29
Tennessee	2,681,337	3,664,142.24	1,838,996.09
Texas	7,576,384	7,366,218.34	3,256,872.24
Utah	1,417,920	1,452,586.86	524,243.32
Vermont	609,375	750,693.40	52,345.06
Virginia	2,382,088	2,883,737.89	578,394.71
Washington	1,927,031	2,002,370.88	893,899.52
West Virginia	1,321,376	1,039,698.29	334,335.98
Wisconsin	3,081,949	3,778,494.29	82,080.01
Wyoming	1,570,758	1,450,238.37	162,707.71
Hawaii	609,375	298,198.65	1,579,975.17
Total	121,875,000	133,340,910.64	39,638,888.04

NATIONAL-FOREST ROAD CONSTRUCTION

During the past year improvements have been completed on 280.9 miles of the forest-road system, bringing the total mileage improved to date with Federal funds to 4,638.4 miles. Of the mileage improved during the year, 254.9 miles were in the Western States and Alaska and the remaining 26 miles were in the forests of six Eastern States. Of the total mileage improved to date, 4,281.6 miles are in the West and 356.8 in the East.

The mileage of forest-highway projects completed during the year and to date by States is shown in Table 33.

TABLE 33.—*Mileage of completed forest-highway projects, by States*

State	Mileage of forest-highway projects completed		State	Mileage of forest-highway projects completed	
	During 1931	Total to June 30, 1931		During 1931	Total to June 30, 1931
Western:			Eastern:		
Alaska	8.9	230.9	Alabama		5.1
Arizona	22.5	358.7	Arkansas	9.7	74.9
California	53.7	437.4	Florida	1.0	65.2
Colorado	20.1	365.8	Georgia		21.4
Idaho	34.5	542.9	Michigan	0.8	8.9
Montana	17.8	409.5	Minnesota	8.2	68.8
Nevada	12.3	126.8	New Hampshire		5.2
New Mexico	8.4	198.8	North Carolina		36.3
Oregon	28.3	705.8	South Carolina		16.0
South Dakota		46.2	Tennessee	3.9	37.4
Utah	32.6	340.5	Virginia	2.4	17.6
Washington	6.2	233.9			
Wyoming	9.6	284.4	Total	26.0	356.8
Total	254.9	4,281.6	Grand total	280.9	4,638.4

In the forest-highway system as approved to date there are 15,024.1 miles, of which 12,538.5 miles are in the Western States and Alaska and 2,485.6 miles are in the Eastern States and Porto Rico. Class 1 highways, which are necessary sections or extensions of the Federal-aid highway system lying wholly within the forest areas, total 1,384.6 miles, of which 923.1 miles are in the Western States. Class 2 highways, which also extend the Federal-aid system, total 7,402.5 miles, of which 7,074.1 miles are in the West. The class 3 highways, those that serve communities within the forests, total 6,237 miles, of which 4,541.3 miles are in the Western States.

The mileage of each of the three classes of highways and the total mileage of the forest-highway system in each State are shown in Table 34.

TABLE 34.—*Classified mileage of forest-highway system, by States*

State	Mileage of forest-highway system			
	Class 1	Class 2	Class 3	Total
Western:				
Alaska			443.9	443.9
Arizona	263.3	491.0	265.0	1,019.3
California	320.5	985.0	976.0	2,281.5
Colorado		1,240.0	483.0	1,723.0
Idaho	4.0	792.7	247.5	1,044.2
Montana	147.4	687.5	363.0	1,197.9
Nevada		373.8	95.4	469.2
New Mexico	115.0	219.0	226.5	560.5
Oregon	66.2	782.4	591.2	1,439.8
South Dakota	2.0	217.0	86.0	305.0
Utah		457.9	290.2	748.1
Washington	4.7	472.8	321.6	799.1
Wyoming		355.0	152.0	507.0
Total	923.1	7,074.1	4,541.3	12,538.5

TABLE 34.—*Classified mileage of forest-highway system, by States*—Continued

State	Mileage of forest-highway system			
	Class 1	Class 2	Class 3	Class 4
Eastern:				
Alabama			41.0	41.0
Arkansas	169.8	34.0	14.0	217.8
Florida		0.7	106.0	106.7
Georgia	31.6	10.2	85.5	127.3
Maine			11.0	11.0
Michigan	49.9		272.5	322.4
Minnesota	41.0	38.5	166.0	245.5
Nebraska			28.8	28.8
New Hampshire	30.0	50.0	49.0	129.0
North Carolina	78.7	50.0	108.9	237.6
Oklahoma			40.0	40.0
Pennsylvania	24.5	16.0	157.0	197.5
Porto Rico			9.0	9.0
South Carolina		6.0	40.0	46.0
Tennessee	36.0	81.0	167.0	284.0
Virginia		38.0	269.0	307.0
West Virginia		4.0	131.0	135.0
Total	461.5	328.4	1,695.7	2,485.6
Grand total	1,384.6	7,402.5	6,237.0	15,024.1

For several years prior to the past year the annual authorization for forest roads and trails had been $7,500,000, of which $4,500,000 was reserved for the more important roads designated as forest highways. For this year the total appropriation authorized was $12,500,000, of which $9,500,000 was made available for forest highways, an increase of $5,000,000, more than doubling the annual sums formerly available.

In addition there was appropriated by the act of December 20, 1930, the sum of $3,000,000 for the purpose of increasing employment. Altogether, the funds available for expenditure this year have been nearly three times as great as the previous authorizations.

An increase of the program of work so great as these additional appropriations required would normally involve a considerable period of preparation. A greater number of surveys must be made, and this, under the conditions that surround much of the forest road work, is a task that can not be dispatched in a moment. Plans in greater numbers must be prepared; contracts advertised and let and contractors' outfits moved to the remote places in which many of these projects are located, all with the additional handicap imposed by the short working season. And, first of all, so great a relative increase in the program can not be handled at all without some increase in the engineering force.

It is, therefore, gratifying to be able to report that, notwithstanding the readjustments necessary to meet the increased demands, the mileage of forest highways placed under construction during the fiscal year to be financed with the regular funds was about 75 per cent greater than in the previous year, and the entire amount of the $3,000,000 emergency appropriation was obligated as required by the

end of the year. Several projects to be paid for with these funds were let to contract within a month of the date of the appropriation.

Most of the additional improvements made possible by the increase of $5,000,000 in the regular appropriation have been located on the Federal-aid system or its more important extensions, that is class 1 and class 2 roads, and the type of improvement required has been higher than that which is adequate for class 3 roads. Because of this fact the costs have been somewhat above the average and the mileage that could be improved somewhat reduced. However, there has been a noticeable reduction in the level of prices for road work during the year and especially during the latter half. Bids received during this period encourage the belief that the low costs will permit adding to the 1932 program a number of projects which it had not been thought possible to include. To do so necessitates a number of additional surveys, but it is believed that these can be completed and the new work begun in time to allow the greater portion of it to be completed before it is necessary to suspend operations for the winter.

ROAD CONSTRUCTION IN THE NATIONAL PARKS

Appropriations authorized by Congress for the construction and improvement of highways in the national parks have steadily increased. For the fiscal year 1930 the expenditure authorized was $3,500,000. For the year 1931 the amount of the regular appropriation was increased to $5,000,000 and the emergency act of December 20, 1930, provided an additional $1,500,000 for further relief of unemployment. For each of the fiscal years 1932 and 1933 appropriations of $7,500,000 have been authorized. Of these latter sums Congress, by a recent act, has authorized the expenditure each year of $1,500,000 for the improvement of roads outside of the parks but serving as approaches thereto.

The construction work of the past year, which by agreement with the National Park Service is supervised by the Bureau of Public Roads, has brought to completion 68.5 miles, making the total thus far improved 370.6 miles, all of which is in the system of major park roads that has been designated, including a total of 1,509.7 miles.

As required by the emergency appropriation act, all of the $1,500,000 provided by it was obligated to definite projects by the end of the fiscal year in spite of the fact that it was necessary to make location surveys for the greater portion of the work before the projects could be advertised for bids.

The considerable increase in funds available for the last fiscal year accounts for the fact that the construction in progress at the end of the year covers 327.9 miles as compared with the program a year ago, involving only 67 miles. Of the current construction program 182.7 miles is stage construction.

The mileage included in the designated system in the several parks and the record of completion during the last year and to date are shown in Table 35.

TABLE 35.—*The program of national-park road improvement and the mileage of roads improved under the supervision of the Bureau of Public Roads*

National park	Mileage of the program	Mileage completed under the supervision of the bureau		National park	Mileage of the program	Mileage completed under the supervision of the bureau	
		During the fiscal year 1931	Total to June 30, 1931			During the fiscal year 1931	Total to June 30, 1931
Crater Lake	70.5	----------	23.3	Yellowstone	369.2	10.6	34.5
Glacier	145.9	----------	32.5	Zion	22.4	.4	9.1
Mount Rainier	122.1	7.4	49.1	Hawaii	83.6	----------	11.2
Grand Canyon	156.7	15.7	75.2	Mesa Verde	47.3	----------	6.0
Yosemite	218.6	10.9	47.4	Acadia	4.5	3.3	3.3
Sequoia	84.5	----------	25.2	Wind Cave	5.4	1.0	5.3
General Grant	----------	----------	4.0	Mount McKinley	73.5	----------	----------
Lassen Volcanic	39.5	19.2	35.5				
Rocky Mountain	64.4	----------	8.7	Total	1,509.7	68.5	370.6
Devil's Tower	1.6	----------	.3				

Probably the most interesting of the projects under construction is the Wawona Road in Yosemite National Park, which includes the construction of a tunnel approximately 4,200 feet in length. Contract for this work was awarded on October 1, 1930, and the project is now about 30 per cent complete. It is anticipated that all work will be completed in advance of the time stated in the contract.

The problem of ventilating the tunnel on this project has required considerable study, in which the bureau has received invaluable assistance from the United States Bureau of Mines. The preliminary report of that bureau indicates that mechanical ventilation will be required, and the Bureau of Mines will be asked to assist in the preparation of the plans for this.

Of outstanding interest among the projects completed during the past year are the south approach to Grand Canyon National Park and the Bright Angel Springs Road in Grand Canyon. In Mount Rainier Park the White River Road and sections A and B of the West Side Highway are among the most important grading projects completed during the past year. In Yellowstone Park the Artist Point section of the Grand Canyon Rim was completed. In the East the grading of the Cadillac Mountain Road in Acadia National Park, Me., was completed. The surfacing of this project is now in progress and covers a length of approximately 3.5 miles.

The most imortant bridge structure completed was Klickitat Creek Bridge on the White River Road in Mount Rainier National Park. This is a reinforced concrete barrel arch with cement-rubble masonry facing.

The end of the fiscal year found plans under way for road construction in the proposed Shenandoah National Park and Colonial National Monument, both in Virginia. Two contracts were awarded for grading approximately 45 miles of roadway in Shenandoah Park at a cost of approximately $700,000. This is all pioneer road construction of the heavy mountain type. Road construction in that section of Virginia is extremely difficult. All grades were kept under 6 per cent wherever practicable and at one point the plans call for a tunnel about 600 feet long. In Colonial National Monument two projects will be put under construction this year. One covers the grading of a section of the proposed highway from Yorktown to

Jamestown Island and the other involves about 1,000,000 cubic yards of hydraulic fill. The length of this fill is about 5,600 feet and is composed of two major fills, one across Indian Field Creek, a distance of approximately 4,400 feet and one across Felgates Creek, a distance of approximately 1,200 feet. The National Park Service has allotted the bureau approximately $527,000 for the construction of these two projects.

RESTORATION OF FLOOD-DAMAGED ROADS

In the last annual report record was made of the passage of acts appropriating various sums as reimbursements or contributions in aid of several States, these appropriations induced by the extraordinary conditions of necessity and emergency resulting from the unusually serious financial losses by such States through damage to or destruction of roads and bridges by floods in 1927 and 1929.

The States to which such aid had been offered at the time of submission of the last report were Vermont, New Hampshire, Kentucky, Arkansas, Louisiana, Mississippi, Missouri, Alabama, Georgia, and South Carolina.

To the first three a total of $5,197,294 was made available expendable only upon work undertaken with the approval of the Secretary of Agriculture after the passage of the act.

To Arkansas, Louisiana, Mississippi, and Missouri a total of $3,654,000 was made available not only for work done subsequent to the passage of the act but also for reimbursement of expenditures made by the States before the act was passed. In every case it is necessary that the State shall have expended or made available for expenditure State funds in an amount equal to the Federal reimbursement or contribution.

To the third group of States—Alabama, Georgia, and South Carolina—separate acts appropriated sums totaling $2,971,628.50, from which a deduction of 2½ per cent was authorized to cover the cost of Federal administration. The total amount actually available to these States is, therefore, $2,897,338. The expenditure of this money is authorized in the same manner as described in the cases of Arkansas, Louisiana, Mississippi, and Missouri.

Since the submission of the last report there has been appropriated by the second deficiency act for the fiscal year 1931, approved March 4, 1931, a fund of $80,307 for similar relief of the State of Florida. The appropriation in this case is not subject to the 2½ per cent administrative deduction and, in the language of the act, is made as "a complete contribution and reimbursement in aid from the United States * * *."

The amounts of these several appropriations (less the 2½ per cent allowed for Federal administration in the case of Alabama, Georgia, and South Carolina), the amounts paid the States up to June 30, 1931, and the unobligated balance for each State are shown in Table 36. The amounts paid during the past year are reported in Table 37.

The mileage of road improved under these acts up to the end of the last fiscal year and the corresponding total cost and Federal payment are given in Table 38. Similar information for roads completed during the past year is presented in Table 39, and for roads under construction at the end of the year and approved for construction in Tables 40 and 41, respectively.

The mileage of the several types of flood-relief roads completed in the several States during the fiscal year 1931 is given in Table 42, and the total mileages completed, under construction, and approved for construction on June 30, 1931, classified by types and by States, are given in Tables 43, 44, and 45, respectively.

TABLE 36.—*Flood relief appropriated, amounts paid to States, and the unobligated balance of the appropriation on June 30, 1931*

State	Appropriated	Paid to the States to June 30, 1931	Unobligated balance
Vermont	$2,654,000	$2,654,000.00	
New Hampshire	653,300	624,142.44	
Kentucky	1,889,994	556,338.50	$1,242,784.76
Total	5,197,294	3,834,480.94	1,242,784.76
Arkansas	1,800,000	1,052,178.29	592,971.26
Louisiana	967,582	533,668.20	143,811.18
Mississippi	628,000	345,266.57	282,733.43
Missouri	258,418		130,865.95
Total	3,654,000	1,931,113.06	1,150,381.82
Alabama	[1] 1,618,500	430,282.33	1,132,283.11
Georgia	[1] 493,416		389,830.93
South Carolina	[1] 785,422		44,180.64
Florida	80,307		80,307.00
Total	2,977,645	430,282.33	1,646,601.68
Grand total	11,828,939	6,195,876.33	4,039,768.26

[1] Does not include fund allowable for administration.

TABLE 37.—*Flood relief paid to the States during the fiscal year 1931*

State	Flood relief paid during fiscal year 1931	State	Flood relief paid during fiscal year 1931
Vermont	$163,258.00	Mississippi	$3,563.66
New Hampshire	60,796.55		
Kentucky	162,742.85	Total	1,589,410.15
Total	386,797.40	Alabama	430,282.33
Arkansas	1,052,178.29	Grand total	2,406,489.88
Louisiana	533,668.20		

TABLE 38.—*Total cost, flood relief, and mileage of roads improved to June 30, 1931*

State	Total cost	Flood relief	Mileage
Vermont	$5,651,965.83	$2,654,000.00	61.2
New Hampshire	1,412,316.37	653,300.00	29.0
Kentucky	1,225,402.88	539,156.95	64.5
Total	8,289,685.08	3,846,456.95	154.7
Arkansas	586,181.70	283,087.73	47.2
Mississippi	11,433.59	3,563.66	.3
Total	597,615.29	286,651.39	47.5
Alabama	280,250.82	137,971.44	32.8
Grand total	9,167,551.19	4,271,079.78	235.0

TABLE 39.—*Total cost, flood relief, and mileage of roads which were completed and final payment made during the fiscal year 1931*

State	Total cost	Flood relief	Mileage
Vermont	$1,016,599.46	$437,051.28	14.0
New Hampshire	77,546.44	38,773.22	2.2
Kentucky	646,773.47	261,528.13	38.6
Total	1,740,919.37	737,352.63	54.8
Arkansas	532,780.42	256,387.09	46.0
Mississippi	11,433.59	3,563.66	.3
Total	544,214.01	259,950.75	46.3
Alabama	53,278.72	24,485.41	3.1
Grand total	2,338,412.10	1,021,788.79	104.2

TABLE 40.—*Total cost, flood relief, and mileage of roads under construction on June 30, 1931*

State	Estimated total cost	Flood relief allotted	Mileage
Alabama	$41,929.57	$20,964.87	8.7
Arkansas	65,489.09	28,405.38	.2
Kentucky	175,131.12	49,152.29	2.8
South Carolina	739,655.96	330,241.34	6.6
Total	1,022,205.74	428,763.88	18.3

TABLE 41.—*Total cost, flood relief, and mileage of roads approved for construction on June 30, 1931*

State	Estimated total cost	Flood relief allotted	Mileage
Alabama	$3,624.03	$1,812.01	0.1
Arkansas	201,046.13	99,744.43	2.6
Georgia	207,169.78	103,584.88	3.7
Kentucky	128,234.67	58,900.00	15.4
South Carolina	1,008,511.62	411,000.00	14.3
Total	1,548,586.23	675,041.32	36.1

TABLE 42.—*Mileage of the various types of flood-relief roads completed and final payment made during the fiscal year 1931*

State	Graded and drained	Sand-clay, untreated	Gravel, untreated	Macadam, treated	Bituminous macadam	Portland cement concrete	Bridges and approaches	Total
Vermont			0.8		2.6	9.9	0.7	14.0
New Hampshire				2.2				2.2
Kentucky	38.2						0.4	38.6
Arkansas	15.8		28.8			.3	1.1	46.0
Mississippi						.3		.3
Alabama	2.2	0.8					.1	3.1
Total	56.2	.8	29.6	2.2	2.6	10.5	2.3	104.2

TABLE 43.—*Mileage of the various types of flood-relief roads improved to June 30, 1931*

State	Graded and drained	Sand-clay, untreated	Gravel, untreated	Gravel surface treated	Macadam surface treated	Bituminous macadam	Portland cement concrete	Bridges and approaches	Total
Vermont			7.0	9.2		6.1	32.5	6.4	61.2
New Hampshire				2.9	4.9	2.3	18.3	.6	29.0
Kentucky	63.8							.7	64.5
Total	63.8		7.0	12.1	4.9	8.4	50.8	7.7	154.7
Arkansas	15.8		30.0				.3	1.1	47.2
Mississippi							.3		.3
Total	15.8		30.0				.6	1.1	47.5
Alabama	19.1	0.8	12.3					.6	32.8
Grand total	98.7	.8	49.3	12.1	4.9	8.4	51.4	9.4	235.0

TABLE 44.—*Mileage of the various types of flood-relief roads under construction on June 30, 1931*

State	Graded and drained	Sand-clay untreated	Portland cement concrete	Bridges and approaches	Total
Alabama	8.6			0.1	8.7
Arkansas				.2	.2
Kentucky	2.6			.2	2.8
South Carolina	.1	0.4	5.0	1.1	6.6
Total	11.3	.4	5.0	1.6	18.3

TABLE 45.—*Mileage of the various types of flood-relief roads approved for construction on June 30, 1931*

State	Graded and drained	Gravel untreated	Macadam surface treated	Portland cement concrete	Bridges and approaches	Total
Alabama				0.1		0.1
Arkansas		1.7			0.9	2.6
Georgia			3.3		.4	3.7
Kentucky	15.4					15.4
South Carolina	12.1			.3	1.9	14.3
Total	27.5	1.7	3.3	.4	3.2	36.1

MOUNT VERNON MEMORIAL HIGHWAY

Construction of the Mount Vernon Memorial Highway, begun in September, 1929, has proceeded rapidly during the last fiscal year and it is now virtually assured that the road will be ready for travel throughout when it is dedicated as a memorial to George Washington in 1932. The ceremony, which is a part of the program of the United States Commission for the Celebration of the Two Hundredth Anniversary of the Birth of George Washington, will be held on April 30, 1932.

With the exception of the construction of about 2¼ miles of hydraulic fill forming part of the grade of the highway, all work

has been done under contract. The hydraulic fill construction has been done by the Corps of Engineers of the United States Army, in a highly efficient manner, and at a cost but little exceeding the estimate, a result which is especially gratifying because the subsurface conditions proved to be unfavorable and the work of constructing the fills rather difficult. The soft, unstable material in the bed of the streams at the points where the fills were constructed ranged from 12 to 30 feet in depth. But, despite the unanticipated difficulties encountered, and the extra yardage which has been placed in the fills, the work—virtually completed at the close of this fiscal year—has been done at little more than half the cost for the same work on the basis of the one complete contract bid received and rejected before the work was undertaken by the Corps of Engineers. Up to June 30 the expenditure for this work was approximately $1,200,000 and this amount is estimated to be within $100,000 of the final cost.

On other portions of the work for which contracts have been awarded the progress up to June 30 was as follows:

Unit 1. Construction of a sea wall and cofferdam and supply of stone for bridge facing. Contract awarded September 12, 1929. Work completed and accepted May 11, 1931.

Unit 2. Dry-land grading, drainage, and incidental construction: Contract awarded February 11, 1930. Work completed and accepted May 9, 1931.

Unit 3. Bridges: Contract awarded April 17, 1930. This contract involves the construction of 11 bridges and a new abutment for the existing Highway Bridge over the Potomac River. Progress on these structures has been as follows:

Boundary Channel bridge, approximately 70 per cent complete on June 30.

New abutment for Potomac River Highway Bridge, approximately 90 per cent complete on June 30.

Highway underpass at south end of Potomac River Highway Bridge, approximately 95 per cent complete on June 30.

Highway underpass at Richmond, Fredericksburg & Potomac Railroad, approximately 97 per cent complete on June 30.

Bridge over Roaches Run, complete on June 30.

Bridge over Four Mile Run, complete on June 30, except for final pointing and cleaning.

Airport overpass, complete on June 30.

Southern Railway overpass, completed on June 30, except for final pointing and cleaning.

Bridge over Hunting Creek, approximately 97 per cent complete on June 30.

Wellington underpass, practically completed on June 30.

Fort Hunt overpass, complete on June 30.

Bridge over Little Hunting Creek, appoximately 98 per cent complete on June 30.

Unit 4, section 1. Paving and incidental structures from Columbia Island to the south side of Hunting Creek: Contract awarded March 11, 1931. Paving begun May 12. Progress satisfactory.

Section 2. Paving and incidental structures beginning at the south side of Hunting Creek and terminating at Mount Vernon. Contract awarded March 20, 1931. Paving begun April 21. Progress satisfactory.

In addition to the above major contracts others awarded before the close of the fiscal year provided for the construction and operation of a concession building at the highway terminus at Mount Vernon, and for the drilling and casing of a well at the terminus. The former was awarded on June 23; the latter on June 25.

Other contracts to be awarded shortly will provide for construction incident to a water supply at the terminus and for the erection of lighting fixtures along the highway.

The landscaping and planting work which forms an important part of the project is being done mainly by force account under the direction of the Bureau of Public Roads and is progressing satisfactorily.

Provision for the construction of the highway from Washington to Mount Vernon as a memorial to George Washington was made by the act of Congress, approved May 23, 1928, which authorized the United States Commission for the Celebration of the Two Hundredth Anniversary of the Birth of George Washington to survey, select, construct, and maintain the road in cooperation with the Secretary of Agriculture.

The appropriation originally authorized for the work was $4,500,000. By act of March 4, 1931 there was authorized an additional appropriation of $2,700,000. All funds authorized have since been appropriated.

INTER-AMERICAN HIGHWAY

Work on the reconnaissance surveys of the proposed inter-American highway from Panama to the United States progressed materially during the past year. Engineers of this bureau, cooperating with the several governments which have requested such surveys, have inspected possible locations of the highway through the countries of Panama, Costa Rica, Honduras, and Guatemala. A similar survey will be made in Nicaragua during the coming fiscal year.

This important activity had its inception in recommendations of the Sixth International Conference of American States, held at Habana, Cuba, in 1928, and the Pan American Congress of Highways which met in Rio de Janeiro in 1929, for consideration and adoption of agreements looking to the construction of a pan-American highway connecting North America, Central America, and South America. More specific action was taken at an inter-American highway conference in Panama October 7–12, 1929, when a resolution was adopted recommending the creation of a commission to carry on the work of determining the most feasible route of an inter-American highway. By act of Congress, approved March 26, 1930, the United States Government appropriated $50,000 to defray the cost of reconnaissance surveys to develop the facts, and to report to Congress on the feasibility of possible routes, the probable cost, the economic service, and such other information as would be pertinent to the building of an inter-American highway or highways.

Under this authority three bureau engineers took up their duties in Central America in June, 1930, headquarters having been provided at Panama through the courtesy of the Panamanian Government. These engineers have continued their work throughout the fiscal year just ended, as previously outlined. In March, 1931, the Inter-American Highway Commission met again at Panama to learn of the progress of the work, with the chief of this bureau and the chief of the bureau's division of highway transport, which is in direct charge of the reconnaissance operations, in attendance.

Field work on the reconnaissance survey will be completed during the coming fiscal year, it is expected, and a comprehensive report will then be made for submission to Congress.

SIXTH INTERNATIONAL ROAD CONGRESS

The Sixth International Road Congress which was held at Washington from October 6 to 11, 1930, proved to be one of the most interesting and important meetings of the Permanent International Association of Road Congresses.

The congress was held in the United States at the invitation of this Government, which holds membership in the association. The chief of this bureau, by appointment of the Secretary of State, served as the secretary-general of the American organizing commission, an agency of the State Department created to administer the appropriation of $55,000 made by Congress to defray the expense of the sessions.

Because of its close association with road work in the United States this bureau was called upon by the Department of State for advice and assistance in preparation for the congress and in assisting and informing the engineers who were in attendance from 64 countries.

TRANSPORTATION AND ECONOMIC AND STATISTICAL INVESTIGATIONS

WESTERN STATES TRAFFIC SURVEY

The survey of traffic on the Federal-aid highway system in 11 Western States, which was begun during the autumn of 1929, was completed in October, 1930, after one year's field work. A complete report on this project, including many tables and maps with explanatory text, is now being compiled.

The States in which the survey was conducted were: Arizona, California, Colorado, Idaho, Nebraska, New Mexico, Nevada, Oregon, Utah, Washington, and Wyoming. In each State the work was done in cooperation with the State highway department.

This project has been the largest of the kind yet undertaken by the bureau, although numerous surveys covering single States or municipal regional areas have previously been made. It has developed the first accurate information available in regard to the flow of traffic on the principal highways of nearly the entire western half of the United States, thus forming the basis for a broad plan of highway improvement in this area.

Among the important data obtained through this survey may be cited the following: Daily average of traffic on all Federal-aid roads in the States surveyed, and traffic data on numerous other roads connecting with the Federal-aid system; estimates of probable future growth of traffic at 5 and 10 year intervals; analysis of the types of vehicles which comprise these totals—passenger automobiles, trucks, or buses; number of persons transported by the passenger-carrying vehicles, and the various capacities of trucks; average daily length of trip of various types of trucks and of passenger cars; number of common-carrier and contract-hauler trucks; origin and destination of vehicles; and percentages of interstate and intrastate traffic.

The scope of the survey is indicated by the fact that more than 20,000,000 vehicles were observed during the year of field work.

MICHIGAN TRAFFIC SURVEY

Another type of traffic survey was conducted in Michigan in cooperation with the highway department of that State, primarily for the purpose of determining facts regarding the character and distribution of traffic on State and local roads and city streets, which may have a bearing upon the future distribution of the cost of highway improvement within the State. Field work on this project began in July, 1930, and its completion, including an extra month of intensive traffic counts in seven leading cities of the State, was scheduled for the end of August, 1931, after which a report is to be compiled and published.

Important facts relating to current problems of highway finance will be produced by this survey, it is expected. The relationship between the use of primary and secondary roads and city streets by various classes of traffic and the source of the funds employed in their improvement and maintenance has never been accurately determined. The assumption generally made is that traffic on the main intercity roads is a comparatively far-ranging traffic, mostly of city-owned vehicles, and that local roads serve a traffic that is predominantly of intracounty origin.

In recent years, however, increasing demands that a larger portion of State-collected revenue be applied to the improvement of local roads have been made by county and township authorities, their claims being predicated upon the assumption that the local roads are required to serve a considerable traffic from outside the local taxing jurisdiction and that the State as a whole should compensate the local government in greater measure for the highway service thus afforded to other than local vehicles. The purpose of the survey in typical townships of Michigan is to ascertain the facts that will indicate whether there is just and reasonable basis for these demands. Cities also claim a share of State revenues in consideration of the use of their streets by rural vehicles, and the special intensive survey in seven representative cities during August bears particularly upon this phase of the problem.

STUDY OF TAXATION IN WISCONSIN

A study, somewhat similar to the investigation in Michigan, but differing in method, was conducted and completed during the year in Wisconsin, the bureau cooperating with the University of Wisconsin.

This investigation was undertaken to determine the facts of highway financing in the State as a whole, with special reference to the true incidence of highway taxation by classes of governmental units and the relationship of highway taxation to taxation for all other purposes. Special effort was made to ascertain where highway funds of all classes were expended, both by road systems and by groups of units of government, and also to establish approximately by a questionnaire method the distribution of highway travel both by road systems and groups of governmental units.

The study, which is later to be extended to other States, was undertaken first in Wisconsin because of the excellence and completeness

of that State's fiscal and tax records. A full report of the work in this first State has been prepared and will shortly be ready for publication.

HIGHWAY TRAFFIC-CAPACITY INVESTIGATIONS

The cooperative agreement with the University of Maryland for a study of highway capacity has been renewed for a second year. The continuation is for the principal purpose of accumulating additional field data to verify that previously compiled. Analysis of last year's observations leads to the tentative conclusion that there is no serious amount of congestion on 2-lane roads up to a traffic rate of about 1,000 per hour, nor on 3-lane roads up to a rate of about 1,600 per hour. In these studies the formation of queues, indicating that the density of traffic is such as to prevent prompt passing of overtaking vehicles, is taken as the criterion of a condition of congestion.

STUDY OF COMMERCIAL TRUCK OPERATION

In cooperation with the Bureau of Foreign and Domestic Commerce of the United States Department of Commerce, an investigation of commercial motor-truck operation, initiated during the preceding year, has been brought nearly to completion. Personal interviews with motor-truck operators in all parts of the United States have yielded a valuable body of detailed data, covering equipment in use, radius of haul, and cost of service. Other general information essential to a clear description of the industry has also been assembled for incorporation in a report.

GENERAL HIGHWAY STATISTICS

General statistics relating to road mileage, annual construction programs, State and local highway funds and disbursements, motor-vehicle registration, proceeds from motor-vehicle and gas taxes, motor-vehicle and gas-tax rates, gasoline consumption, State highway bond issues, and highway-bond financing are regularly collected and published in a series of annual tabulations. This material is assembled by no other agency of the Federal Government or States, and its collection is essential to the proper administration of Federal-aid road work. The information is in constant demand by other agencies of the Government, by the States, and by the public.

PRODUCTION COST STUDIES

Unit costs in most lines of highway-construction work are very largely controlled by the rate of production. This is because the daily or hourly cost of operating a modern road-building plant is practically independent of the rate of production so long as the crew and plant are on the job. Consequently, the most effective way to reduce unit operating costs is to increase the rate of production, for as the rate of production increases the unit cost of the work decreases in very nearly the same ratio.

In order to determine definitely how much the rate of concrete road production with standard 27-E pavers could be increased by increasing the size of the batch without any injury to the quality of the concrete, a series of extensive field tests was conducted in cooperation with the highway departments of several States. These tests show conclusively that the more modern 27-E concrete pavers can handle without difficulty a batch at least as large as 35 cubic feet without any sacrifice of either strength or uniformity. The tests further demonstrated that a 33-cubic-foot batch, when mixed during the period indicated by a batchmeter setting of 50 seconds, produced as strong and uniform concrete as did the standard batch when mixed either 50, 60, or even 80 seconds. On the basis of these studies, the State highway department of Wisconsin adopted as its standard a 33-cubic-foot batch with a mixing time of 50 seconds. These specifications make possible an increase in actual production of approximately 27 per cent over the previous specifications, which required a mixing time of 60 seconds and a batch of not to exceed 30 cubic feet. Wisconsin is the second State to adopt officially a mixing time of 50 seconds, California being the first.

But the so-called "mixing time" or time during which all the materials must be in the mixer and subject to the mixing action is not all of the mixing cycle. Time is also required to get the batch into the mixer and out of it. In controlling the rate of production this charge and discharge time is proportionately just as important as the mixing time. For some time it had been noticed that the discharge time of the larger "pugmill" type of mixers generally used in sheet asphalt and bituminous concrete work was very long. Recent improvements, based largely on the bureau's studies and suggestions, have not only improved the mixing action of this type of mixer, but have reduced the discharge time by more than half, thus materially increasing the possible rate of production. Other improvements, long advocated by the bureau's division in charge of this work, include a positive control of the length of the mixing time, and a faster and more uniform method of operation and control of the charging of the batch. These have been added to the new mixers.

The general aim in this work is to find and develop means and methods which will increase production without impairing the quality of the finished product. Quality is always held to be the first essential. No methods, however promising as to speed or unit cost, are tolerated if they show any indication of reducing the quality of the finished product below the specified standards.

The field studies of direct production problems have been continued with gratifying results. These studies relate, (1) to the elimination or reduction of time losses in the performance of all direct operation, (2) to the coordination and synchronization of the rate of production of the various subsidiary or dependent operations with that of the key equipment, and (3) to eliminating unnecessary operations and expediting those which are really necessary. To give these studies immediate practical value to the highway industry the engineers of the bureau work almost entirely on selected, typical construction projects and in close cooperation with the contractor, his superintendent, and the various highway officials in charge of the work. Nothing is permitted which might in any way reduce the quality below the standards called for in the contract. But with the main-

tenance of quality established as the first essential, all other conditions are studied and analyzed in order to determine the causes which are operating to hold down production and then to devise means for their reduction or elimination.

The extent to which the construction industry can and does profit from these studies is well illustrated by the following example: In the fall of 1929 two engineers were assigned to study a large asphaltic construction project in Monterey County, Calif. This organization was already known for its excellent methods, skilled supervision, and high rates of production, and when the engineers were assigned it was the intention that they should observe and study the possibility of adapting these methods to more general use. However, a thorough analysis of the production processes disclosed opportunities for still further improvement. The management, which was especially alert, at once seized these opportunities with the result that what was then a State-wide record of 802 tons of asphaltic concrete placed per 8-hour day was established as an average for the entire job. But the engineers felt sure that this was not the limit of what this organization was capable of producing. Consequently, this same organization was again studied on another job early in 1930. On this job a more thorough elimination of all time losses and a better synchronization of the various operations resulted in raising the average rate of production to 927 tons per 8-hour day.

Neither the engineers nor the management yet felt that the final production limit of this organization had been reached, and a third study was undertaken during the fall of 1930. Opportunities to increase the rate of production were again found and utilized, with the result that the average rate of production per 8-hour day for the entire period from August 18 to October 8 was raised to what was then, so far as is known, a world record of 1,204 tons per day.

The really significant thing about these studies, however, is not the fact that the rate of production of an already highly efficient organization was increased 50 per cent, but that it was found possible to obtain this increased production without any appreciable increase in the daily operating costs. Consequently, the decrease in unit operating costs was of real moment.

Of course, not all jobs on which studies have been conducted have yielded such gratifying improvement in the rate of production. On the other hand, very few projects have been found on which some definite increase could not be obtained without corresponding increase in the cost of operation. The possibilities can be appreciated from the fact that on what might be called average jobs, nearly half of the time of the crew is unproductive as measured by the possible output of the mixer, while on the above-mentioned project on which asphaltic concrete was placed at an average rate of over 150 tons an hour, less than 3 per cent of the crew's time on the job was unproductive.

The number of contractors with whom the bureau can cooperate in actual demonstrations of this kind is limited, but the benefits are nevertheless very far-reaching. The better methods of operation developed during the studies at once become the standard practice of the individual contractor on his future work, and under the prevailing keenly competitive conditions existing in the highway industry, improved methods are quickly noted and copied by others.

Definite information on the methods and principles developed in this work is also disseminated from time to time through reports and papers read before meetings of highway engineers, contractors, and technical societies, or published in the technical journals. In these ways the benefits of these studies are being widely extended and the principles and methods developed are being put into successful operation by an increasing proportion of the most progressive road builders.

HIGHWAY ACCOUNTING METHODS

During the past year the bureau has assisted several State highway departments in the development and installation of uniform accounting and statistical procedures designed to supply full and complete records of income, expenditures, and accomplishments in construction, maintenance, and administration. Standard definitions have been developed which cover the various activities in which the several highway departments are engaged. These serve as a basis for setting up a system of accounts and records which will fully meet all the accounting requirements of the department and at the same time provide in readily available and practical form complete statistical information on any desired line of activity. These accounts and records are based on the use of the most modern bookkeeping and tabulating equipment in order to give prompt and accurate service at the lowest possible cost. The general adoption of such uniform systems of accounts and records will not only be of great value to the individual State in planning and carrying on its various activities, but will also make possible an intelligent comparison of the cost of various methods and kinds of road construction and maintenance as carried on in the several States, a comparison which is not at present possible because of the dissimilar form of the available records. During the year assistance of this kind has been given to the States of Florida, Georgia, Indiana, Mississippi, Oklahoma, and Tennessee.

Assistance was also given to the State of North Carolina in formulating a more efficient and economical method of administrative and financial control of all the more important former county or township roads of the State. The background for this plan included a survey of the financial records of every county with special regard to road revenues, road expenditures, and road indebtedness. A map of each county was also prepared showing all the public roads divided into three classes according to their traffic importance. This information was laid before the State legislature, which enacted a new highway law placing all the more important former county roads under the direct control of the State highway department.

PHYSICAL RESEARCH

SUBGRADE INVESTIGATIONS

Previous reports have described the general problems involved in the subgrade investigations and the steady progress which has been made in their solution. During the last year these investigations have been continued, as in the past, with the cooperation of the Bureau of Chemistry and Soils and various State highway departments and educational institutions.

The work which has been done has been confined in large part to studies of the underlying physical and chemical laws which control the characteristics of soils, and the identification and classification of soils with respect to their performance in highway subgrades. As progress has been made it has become increasingly apparent that the identification of soils with respect to their performance as subgrades and the application of this knowledge in practical road construction constitutes a specialized branch of highway engineering which is extensive in scope and intricate in character. It includes the classification of soils according to the requirements of various kinds of service and the development of tests which disclose the degree to which soils may perform the service required. It has practical application in the solution of a wide range of problems varying, for instance, from the design of satisfactory sand-clay road surfaces to the methods of constructing massive fills.

In one case the answer to a specific subgrade problem may be furnished merely by visual inspection of the soil in the field. In other cases, comprehensive investigations of the soil both in the field and in the laboratory may be required to furnish the desired information.

The manner of making cuts and constructing fills, the degree to which the subgrade should be compacted or otherwise manipulated, the means which will best furnish the required degree of compaction or manipulation, the proper proportions in which soils of different character may be combined to produce stable subgrades. the decision as to whether a subgrade soil shall be treated or replaced with a better material and the depth of treatment or replacement, all depend on fundamental characteristics of the soil.

In addition, specific subgrade problems are influenced to a large degree by local climatic conditions and the arrangement of soils in the soil profile. This is illustrated by the requirements for the design of adequate drainage systems. The failure of subdrains to furnish the desired stability of subgrade soils may be attributed in many instances to the practice of placing them according to arbitrary standards of spacing and depth, without due regard to such factors as the source of water to be removed, the character of soils in the several soil layers and the arrangement of these layers in the soil profile. As research in soils has progressed the hopelessness of standardizing drainage design, on the basis of such simple requirements as the spacing and depth of underdrains, has become evident.

The various problems relating to the best utilization of soils in highway construction are so complex as to require for their solution the services of men specially trained in this work. Moreover, the most effective application of the knowledge which has been developed can best be secured by the various State departments charged with the responsibility for highway construction, by assigning the study of subgrades and the solution of subgrade problems to specially trained men in the State organizations.

One of the important services now rendered by the bureau is the assistance which is being given to State highway departments which desire it, in training men for the subgrade work, and helping to organize intensive subgrade study by the departments themselves. From time to time special courses of instruction in field and labora-

tory procedures and the interpretation of test results are given at the subgrade laboratory of the bureau at the Arlington Experiment Farm, at Rosslyn, Va., to employees of State highway departments authorized to attend and, when requested, subgrade specialists of the bureau are assigned to cooperate with State highway departments in the organization of subgrade divisions. The number of States which have taken advantage of this assistance, and have organized independent subgrade investigations, is very gratifying.

Much of the previous work, such as studies of frost heaving, loss of stability, and detrimental volume-change of soils, has been of a general nature for the purpose of determining fundamental properties. The investigations are being broadened gradually as circumstances warrant to include more specific problems, such as the warping of concrete pavements which has been observed on certain types of heavy soils, the disintegration of concrete in pavements as it may be affected by subgrade constituents, and the methods most suitable for compacting earth fills of various types of material. The aim of these later studies is to determine preventive measures or methods of construction best suited to the local conditions encountered.

During the year instructive reports have been published and others have been prepared for publication during the coming year.

LOW-COST ROAD INVESTIGATIONS

The construction of satisfactory road surfaces of low cost to serve the lighter traffic of the secondary roads has been an increasing activity of State highway departments for several years. The bureau has been active in investigations designed to produce additional information on the most effective use of available materials in roads of this character and these studies are being continued.

An experimental project in California, conducted in cooperation with the division of highways of the California Department of Public Works, has been described in previous reports. Construction of the experimental road was completed during the summer of 1930, and the various sections are now under observation. Publication of a progress report during the next year is contemplated.

Construction of an experimental road in the sand-hill area of Nebraska, also described in previous reports, was completed during the summer of 1930. A progress report describing the construction and the early behavior of the experimental sections will be prepared for publication during the coming year.

Observations have been continued on three projects in South Carolina which were constructed and are maintained by the State highway department in cooperation with the bureau. These projects have a total length of about 32 miles and include 55 experimental sections. One of the projects was discontinued at the close of the fiscal year on account of partial relocation of the road and reconstruction with a higher type of surfacing. A final report on this project will be prepared for publication next year. A progress report on one of the remaining projects is ready for publication, and an early report on the other project is contemplated.

The cooperation with the Asphalt Institute in the study of the uses of asphalt in low-cost road construction, described in some detail in previous reports, has been continued. During the year

cooperative arrangements have been made with representatives of the tar industry for a similar study of the uses of tar, and a field survey of tar-treated roads in North Carolina has been completed.

A most important cooperative study, having as its object the ultimate simplification and standardization of specifications for the liquid asphaltic materials which are used so extensively in low-cost road work, and involving the Bureau of Public Roads, the State highway departments, and the asphalt industry, has been inaugurated during the past year. For materials of this character, the great number of specifications for products intended for similar purposes, and the lack of agreement regarding methods of testing and test requirements, has created a confusion which is detrimental to the best interests of both producer and consumer. By means of cooperative tests of a great number of samples of liquid asphalts of all classes, made in accordance with a common scheme of analysis and also in accordance with the specification requirements of the various State highway departments, there is being accumulated a mass of data relative to the fundamental properties of these materials. These data will be used as a basis for future agreements on uniform test procedures and uniform specification requirements.

MOTOR VEHICLE IMPACT INVESTIGATIONS

From the standpoint of road design two important changes in the character of heavy motor vehicle traffic are taking place. The first of these is the general adoption of pneumatic-tire equipment and the second is the general increase in operating speeds.

To determine what impact reactions may be expected from heavy, high-speed trucks and buses an investigation has been conducted in which a modern bus chassis, carrying certain loads and equipped with various types of tires, was driven at speeds up to 55 miles per hour over definite conditions of pavement roughness and the impact reactions measured. From these tests definite information concerning the magnitude of the impact reactions developed by vehicles of this type was obtained and the effect of such variables as road roughness, load, speed, tire type, rim width, and inflation pressures was established. This valuable material has been made available in a published report.

The three reports of various other phases of this work, which were described in the last annual report as having been prepared for publication, were published also during the past year.

INVESTIGATION OF CONCRETE PAVEMENT DESIGN

Because of the great amount of money being expended for the construction of concrete pavement, possible improvement in the structural design of pavement slabs is a matter of considerable economic importance. The proper cross section to be used has never been established with precision and there is very little reliable information for the design of effective longitudinal and transverse joints.

In order to provide information on these features of pavement design, 10 concrete slabs, 20 by 40 feet, have been constructed at the Arlington Experiment Farm. These are of various shapes of cross

section and include various joint designs. On these slabs known loads are being placed and the effectiveness of the different designs determined by observation of the stresses and deflections which result from these loads. A comparison is being made between the observed behavior of these slabs under load and that which should theoretically occur. A study of the effect of temperature on the size and shape of the sections is also being made. The data which are being obtained should be of considerable assistance in developing a rational method of concrete pavement slab design.

INVESTIGATIONS OF CONCRETE AND CONCRETE AGGREGATES

The investigation of paving concrete involving the construction of an experimental road one-half mile in length, to which reference was made in the annual reports for the preceding two years, has been completed and a report issued. These studies are of special interest because they have made it possible for the first time to base conclusions upon tests of the actual pavement as well as upon tests of small-size specimens. In this way valuable information has been obtained regarding the significance of certain routine tests which have been applied to concrete for many years and which have so far been the only basis upon which it has been possible to proportion concrete mixtures.

Certain of the more important conclusions derived from this investigation follow:

For a constant sand-cement ratio, both the average strength and the uniformity in strength of a concrete pavement slab will be decreased by increasing the percentage of coarse aggregate in the mixture beyond the amount ordinarily used in practice.

When very dry mixtures are used (less than 2-inch slump) the strength of the pavement slab will be lower and the amount of honeycomb in the concrete will be greater than when concrete of medium consistency is employed (2 to 3 inch slump).

Tests made on small molded specimens are a reasonably satisfactory measure of the strength of the concrete in the pavement provided the concrete is of medium consistency. For very dry mixtures the strengths obtained on molded specimens are apt to be higher than the strength of the pavement.

The amount of honeycombing observed in cores drilled from the pavement does not necessarily measure the amount of honeycombing in the pavement itself.

Investigations of paving concrete will be continued during the coming year and will include a study of the effect of using high-speed electric vibrators for compacting the concrete; a study of the effect of continued surface manipulation of the concrete by hand for the purpose of removing excess water; and, a study of the effect of hydraulic lime on the strength and workability of concrete.

Investigations of factors affecting the durability of concrete are being continued. As stated in the report of last year, studies of this character are of long duration because of the time necessary to produce in the laboratory conditions which are comparable with actual weathering. The problem has likewise been complicated because of lack of information on the proper methods of testing to be employed. For this reason the first experiments conducted by the bureau along this line have proved of value chiefly in throwing light on the

problem of a standardized test procedure. It is hoped that, as a result of these preliminary tests, it will be possible to establish in the near future a standard method of test which may be used in investigating the resistance of concrete to weathering action.

During the year a study of methods of testing sand to be used in concrete was conducted in cooperation with technical committees of the American Society for Testing Materials and the American Association of State Highway Officials. This study has resulted in the development of a method of test, based on the well-known water-cement ratio law, which has been adopted as a tentative standard by both of these organizations.

The increasing use of the flexure test for determining the strength of concrete has called for standardization of a laboratory method of test. An investigation of a method proposed as a standard by the American Society for Testing Materials has recently been completed by the bureau and the results will be reported during the coming year. These tests were for the purpose of determining the effect of certain variables, such as size of test specimen, method of loading, etc., upon the test results.

A series of tests involving the construction of concrete test walls of various heights, for the purpose of determining the effect of segregation during placing, was also concluded during the year. This problem is of importance in bridge construction, as well as in other concrete works where it is necessary to fill deep forms in a continuous operation, and where there is a tendency of the water in the concrete to rise to the top as the form is filled, resulting in concrete of nonuniform composition. In this series of tests concrete of a single proportion was used and the sand was rather fine. The forms varied in depth up to 12 feet. Under these conditions it was found that segregation or water gain was negligible even when mixes having slumps as high as 8 inches were used. It is probable that further tests, using forms of considerably larger cross section and with a coarser sand, will reveal a more pronounced tendency toward segregation.

This investigation presented an opportunity to obtain a limited amount of data on the effect of vibration, for the consolidation of fresh concrete, on the pressures developed against the formwork. This is of particular importance in the design of deep forms, such as those for the spandrel columns of arch bridges, when the use of vibratory methods of consolidation are contemplated. The indications of the data are very definite and a report of this phase of the investigation has been published.

HIGHWAY BRIDGE INVESTIGATIONS

In cooperation with the authorities of Allegheny County, Pa., an investigation has been made of two lightweight steel and concrete bridge-floor slabs of similar type. Slabs of this type have shown satisfactory structural strength under static loads, but the question arose as to the effect of impact of motor vehicles on the structural behavior. Floor slabs about 15 feet square, supported by typical steel beam and stringer construction, were subjected to a very complete series of static and impact loadings. A report of this project will be published during the coming year.

The program of bridge-floor slab tests carried on in cooperation with the Port of New York Authority and described in the last two annual reports has been completed and the report approved for publication.

In the last annual report mention was made of the investigation of the Freyssinet method of concrete-arch construction to be made in cooperation with the Oregon State Highway Commission. The field work in connection with this project will have been completed by the end of the construction season of 1931 and it is anticipated that a report will be available for publication before the close of the next fiscal year.

DIVISION OF AGRICULTURAL ENGINEERING

IRRIGATION INVESTIGATIONS

DUTY OF WATER

All of the Western States are interested in utilizing to greatest advantage the available supplies of irrigation water, and most of them have been cooperating with the Bureau of Public Roads in studies relating to duty of water. These involve particularly investigations as to the amounts of water required for most economical production of crops, the prevention of waste in applying the water to the crops, and net irrigation requirements of lands under various physical, climatic, and agricultural conditions.

The investigations of water losses by evaporation and transpiration of plants in the delta of the San Joaquin and Sacramento Rivers, in cooperation with the Department of Public Works of California, have been continued. The field work has been completed, except for some special tank experiments to observe certain transpiration phenomena in weed and tule areas. The results of these investigations are to be published by the department of public works. A manuscript on Research into Rainfall and Evaporation and Transpiration Losses and their Relation to Irrigation in the Santa Ana Basin was prepared, in cooperation with the same State department.

A bulletin on Cost of Irrigation Water in California was issued during the year by the department of public works of the State, making available the results of studies carried on cooperatively by that department, the College of Agriculture of the University of California, and the Bureau of Public Roads. The costs to farmers are shown to have ranged in 1929 from 37 cents to $84.33 per acre, and from 30 cents to $116.45 per acre-foot. Costs generally were lowest in central California and were highest in the southern part of the State, particularly for isolated tracts in the Sierra foot hills.

A new study to determine the effect of certain types of irrigation and of various applications on cotton and rice was begun in cooperation with the College of Agriculture of the University of California. Growers of these crops also cooperated, informally. Owing to the extreme shortage of irrigation water, it is doubtful if any definite data will be forthcoming before another irrigation season has passed.

In southern California the duty-of-water studies embrace the use of water by both cultivated and native wild plants; evaporation from

soil and water surfaces; rainfall penetration on the valley floor; and other phases of the most economical use of water. In cooperation with the Bureau of Plant Industry and the Forest Service, studies have been begun to determine the water requirements of types of trees and shrubbery growing in canyon bottoms or stream beds. Results so far indicate that water losses through use by river-bottom vegetation in two summer months may equal the annual irrigation requirement of an orange grove of equal area.

The study of duty of water in the Rogue River Valley in Oregon, with special reference to pears, which was started during the fiscal year 1930, has been continued through this fiscal year, and has been considerably enlarged because of developments resulting from the earlier studies. This project is maintained cooperatively by the division of agricultural engineering, the Oregon Agricultural Experiment Station, and Jackson County. The last named has just purchased a completely equipped orchard for use in these experiments. Arrangements have been made for participation of the Bureau of Plant Industry in these studies during the coming year.

WATER SPREADING FOR UNDERGROUND STORAGE

Long before the present cycle of dry years which has resulted in a serious shortage of irrigation water, underground storage of water had been considered an urgent problem, but it had been treated in only a casual way. In many parts of southern California, in one region of central California, and in certain small areas in Arizona, Colorado, and Utah some work had been done toward conserving surface run-off by spreading it to percolate to the underground water table where it could be stored and pumped back to the surface when required. In 1930 the division established its first experimental plot and in 1931 completed two check plots at the mouth of San Gabriel Canyon in Los Angeles County, Calif. These are to be operated simultaneously in order to obtain data on methods of applying the water to the percolation areas, and particularly on the relative rates of percolation into ground, in its natural condition, when cleared of vegetation, and after the surface has been plowed.

CUSTOMS, REGULATIONS, AND LAWS RELATING TO IRRIGATION

During the year Technical Bulletin No. 254, Irrigation Districts, Their Organization, Operation, and Financing, was issued, superseding an earlier publication of similar title. The irrigation district has become the dominant type of irrigation organization in many sections of the West. It has been found, on the whole, better adapted to the improvement and extension of existing communities than to entirely new development. At the end of 1928, 407 such districts were actually operating and in that year supplied water to approximately 4,060,000 acres. Of the 398 districts that had issued bonds, 65 per cent had not failed in payment of principal or interest to the end of 1928. Of the bonds that had been sold up to that time, 71 per cent were then in good standing, but 18 months later the percentage had dropped to 67. Experience has shown that in determining the economic feasibility of enterprises prior to their financing

greater allowance should be made for unfavorable economic conditions during the period that the bonds will be retired.

A Summary of Irrigation-District Statutes of the Western States has been printed as Miscellaneous Publication No. 103, bringing together the provisions of the different States to permit comparison of the various requirements and obligations imposed and rights conferred.

FLOW OF WATER IN IRRIGATION CONDUITS

Hydraulic investigations of irrigation ditches and other conduits, the results of which have been made available in a series of department publications on flow of water in irrigation channels, wood-stave pipe, concrete pipe, and steel pipe have been continued this year. Measurements of the carrying capacities of certain flumes and tunnels have been made. The accuracy of the formulas developed from these studies gives them great value in designing irrigation conduits of sufficient size to carry the required quantities of water without wasting funds in constructing works larger than necessary. The collection of such data is being continued.

SEWAGE IRRIGATION

The study of sewage irrigation at Vineland, N. J., has been continued. The amount of sewage applied to the fields has been measured and samples are sent weekly to the laboratory of the New Jersey Agricultural Experiment Station for analysis to determine its fertilizer value. From the results of these analyses the approximate amounts of fertilizer applied to the fields may be determined. Water from wells at different points on the sewage farm has been analyzed bacteriologically and found unpolluted.

Experiments on the distribution of sewage have shown a system of underground terra-cotta pipes with concrete outlets located 3 feet apart to be superior to ditches as a distribution system. Application through furrows has proved best for very open soils, and application in alternate furrows appeared to be as efficient as application in every furrow, if not more efficient.

In order to compare the effects of irrigation with sewage and with well water, 1 acre has been equipped with overhead irrigation piping.

DRAINAGE INVESTIGATIONS

RUN-OFF AND DITCH CAPACITIES

The rainfall and run-off on nine watersheds in Ohio are being measured to determine drainage coefficients to be used in determining channel requirements. In eight of the channels values of n in Kutter's formula are being determined.

Some 30 stream-gagings were made, mostly of low-flow stages owing to the extensive drought. These low-stage measurements are of assistance in determining the trend of a series of phenomena extending from minimum to maximum flow. The division collaborated with the United States Geological Survey, which is making a study of minimum flow to determine water-power resources and sewage-disposal facilities.

The chief factors apparently influencing the concentration of the run-off are topography, rainfall intensity, and seasonal changes in soil and surface covering. A study has been in progress to determine whether there can be included in the run-off formula a factor which will be representative of the influences of topographic features alone. The rainfall is measured directly. The only unknown variable is, then, the seasonal change in soil and surface covering. Results of this study have been very encouraging but more intensive tests are needed, requiring very accurate rainfall measurements. To this end the standard rain gages have been replaced by automatic weighing and recording instruments. The automatic instruments not only afford a more accurate sample of rainfall intensities, but also permit a more exact determination of periods of concentration.

Experiments have been made on methods and costs of cleaning drainage ditches with dynamite and a report has been prepared.

The investigations of the run-off from the Ralston Creek watershed, Iowa, were continued and a report covering five years' work on this project is in preparation.

OPERATION AND MAINTENANCE OF DRAINAGE PUMPING PLANTS

Studies have been conducted for several years at pumping plants along the Illinois and Mississippi Rivers to determine the costs of pumping with different types of power and how such costs can be reduced. The manuscript for a department bulletin has been prepared. It has been found that the average costs of pumping with Diesel engines and with electric motors do not differ greatly. Many small and medium-sized steam plants, having been found inefficient, have been abandoned. Operating costs have been reduced by employing a competent engineer to supervise the operation of the plant; by properly regulating the speed of the pumps; by adjusting, cleaning, or repairing pumping equipment; and by installing more economical equipment. In some districts maintaining a lower water level in the suction bay would provide better drainage for the low lands.

A manuscript has also been prepared relating to the design and operation of pumping plants. The investigations have shown that screw-type impellers operate efficiently at low lifts, and that synchronous motor units with two motors on the shaft, direct-connected to the pump, operate efficiently.

Some promising experiments have been started on observation wells in one Illinois drainage district to determine the effect on the ground water of lowering the drainage water by pumping. In addition, on a number of plots a study is being made to determine the effect of different depths of the ground water table on crop yields.

HYDRAULIC EXPERIMENTS AT UNIVERSITY OF IOWA

The experiments on the obstruction of pile trestles to the flow of water, noted in previous annual reports, were completed during the year and a report on them prepared. It was found that a double-track pile trestle with the piles in line offered about twice as much resistance to flow as a single-track trestle. A double-track trestle with the bents offset offered a little more obstruction than a similar trestle with the bents in line. When a trestle crosses a stream

obliquely, bents set in echelon cause less backwater than bents set at right angles to the axis of the bridge.

The investigations of the obstruction of bridge piers to the flow of water were continued.

The Ramser silt-measuring apparatus in combination with a 2-foot Parshall measuring flume was calibrated in the hydraulic laboratory. Various modifications of the apparatus were tried. The apparatus was found to be sufficiently accurate from a hydraulic standpoint to warrant its use on the bureau's soil-erosion experiment farms.

DURABILITY OF DRAINTILE

The investigations at University Farm, Minn., on the durability of draintile under exposure to various conditions of soil and frost action have been continued, in cooperation with the Minnesota department of Agriculture and the Minnesota department of drainage and waters. The results of the studies relating to frost resistance of clay tile have been issued in a mimeographed report. These studies have made possible a general correlation between absorption and freezing tests of tile from various clay-tile plants in Minnesota and Iowa.

In the concrete-alkali work, 5-year tests have now been completed for 309 series of concrete specimens exposed to the action of sulphate water. Much of value has been learned about the use of certain admixtures in connection with curing temperatures only slightly higher than those used at commercial plants.

SOIL-EROSION CONTROL

Eight experiment farms have now been established where soil-erosion-control and moisture-conservation studies are being conducted in cooperation with the Bureau of Chemistry and Soils and the State agricultural experiment stations. These are located at Guthrie, Okla.; Temple and Tyler, Tex.; Bethany, Mo.; Hays, Kans.; Pullman, Wash.; Clarinda, Iowa; and Statesville, N. C.

On the soil-erosion experiment farm near Guthrie, Okla., it was found that from 3 to 24 inches of soil had been removed from a badly eroded and gullied area which has been under cultivation for about 30 years, as compared with no appreciable erosion on the virgin land. A careful record of crop yields from two comparable areas of virgin and badly eroded land showed a yield of 75 per cent more cotton on the virgin land, the average yields being 156 and 89 pounds per acre, respectively. At 14 cents a pound for cotton, there would be a difference of $9.38 per acre in favor of the virgin land. The cost of constructing the terraces on the virgin land was about $2.50 per acre and on the gullied land about $14.50 per acre. These results demonstrate conclusively the advisability of starting the control of erosion when the land is first broken, rather than waiting until it has become badly gullied.

The effectiveness of terraces in controlling erosion is demonstrated by an experiment in which the soil losses from an unterraced and a level-terraced area were measured. As the result of a rain of 1.22 inches, 5.38 tons of soil per acre were lost from the unterraced area and only 0.21 ton per acre from the terraced area. The importance

of giving proper grades to the terraces is indicated by the fact that about three times as much soil was carried off the field by a terrace with a grade of 6 inches per 100 feet as by a terrace with a grade of 4 inches per 100 feet. Concerning the required height of terraces it was found, for terraces up to 700 feet long on ground having a slope of 5½ per cent, that with vertical spacings of 2, 3½, and 5 feet, heights of 12, 15, and 18 inches, respectively, were required to carry away the water from a fairly heavy rain.

Experience with level terraces having closed ends, designed to retain all of the rain that falls on the land above the terrace, indicates that this kind is not advisable for regions of high annual rainfall and for soils that can not absorb water rapidly. While level terraces have resulted in increases of 30 to 40 per cent in crop yields in west Texas and Oklahoma where the annual rainfall is light and the soil absorbs a large part of the rainfall, it was found on the Guthrie farm that an oat crop was decreased in yield nearly 60 per cent by water standing in the terrace channel.

It has been found that much of the tractor equipment now being manufactured is not sufficiently flexible to operate satisfactorily over terraces. The operation of several machines has been studied and suggestions made to the manufacturers for improving their equipment. The manufacturers realize that ultimately much of the land in the United States must be terraced and that their equipment must be designed to operate successfully over terraced land.

Data thus far obtained seem to indicate that the broad-base Mangum terrace can be constructed most economically by building from both sides on gentle slopes and from the upper side on steep slopes. It has also been found that where terraces are built from both sides the furrow below the terrace should be obliterated, otherwise this furrow fills with water after heavy rains, overflows at the low points, and thus causes the formation of small gullies down the slope between the terraces.

The use of large machinery designed for building and maintaining roads, borrowed without cost except for the labor and fuel required in its operation, has in many cases effected a considerable saving in the cost of building farm terraces. A recent statute in Oklahoma permits counties and townships to loan such equipment for this purpose, on the terms stated.

For check dams in small gullies experiments at the Guthrie farm indicate that a height of about 2 feet is most satisfactory from the standpoint of economy and successful operation; that some sort of anchorage is needed for brush dams, even where the gully has a very limited drainage area; that the sides of the gully above the dam should be protected against erosion; that the dam should not reduce the cross section of the gully so much as to cause overflowing of its banks; and that a more rapid filling above a brush dam occurs when care is taken to pack the brush closely so as to reduce the size of the interstices.

FARM MACHINERY INVESTIGATIONS

CORN-BORER CONTROL

Because of the drought during the corn-growing season of 1930, the regular spread and normal increase in intensity of the European

corn borer was considerably retarded. For the same reason stalk growth was stunted and much more fodder was cut for feed than ordinarily. Therefore, certain activities connected with the development and testing of corn-borer machinery were slowed up and others had to be postponed. Shredding and baling tests could not be conducted because of scarcity of stalks that even approximated normal growth, and heavily infested stalks were difficult to find. Nevertheless, considerable progress was made.

The high-pressure field burner developed in previous years for combating the European corn borer has been converted into a low-pressure burner, and the rigid hood has been replaced by a flexible hood in three sections to facilitate burning on uneven ground. Field tests in borer-infested fields showed this burner to effect a high mortality of the borers, but indicated that the initial and operating costs for the burner will be considerably greater than for other control machinery now available. No further work with burners is planned for the near future.

The 3-row stalk shaver attachment for a single-row corn cultivator, developed last year, has been reconstructed so as to fit each of six of the principal makes of cultivator. A similar attachment for cutting four rows was developed for two makes of 2-row cultivators.

The 4-bar, side-delivery rake was further improved. Field tests were conducted on experimental rakes made by three manufacturers. These rakes performed satisfactorily when tested in corn; they are still in the field for test in alfalfa, timothy hay, and soybeans. In order to cover two rows the reel on the side-rake stalk loader with 2-row shaver attachment had to be lengthened 2 feet. Plans are under way to change the angle of the reel so that two rows can be raked without lengthening the reel.

A down-stalk lifting-finger attachment was developed for corn binders, and probably can be made adaptable to other row-crop harvesters.

A 2-furrow, 21-inch plow was built at Toledo, Ohio, and performed very creditably on three different soil types. A floating trash shield, for scraping the stalks into the open furrow from part of the furrow slice as it is turned, promises to be an aid in clean plowing for borer control. Careful studies have been made of the characteristics affecting the draft of plows. Further draft tests will be made to determine the most important factors involved.

Cooperative work has been undertaken with most of the New England agricultural experiment stations and with those of Illinois and Pennsylvania. Headquarters for the New England work have been established at South Norwalk, Conn.

A new experimental farm has recently been acquired near Toledo, Ohio, which will be operated jointly with the Bureau of Entomology.

ARTIFICIAL DRYING OF FORAGE CROPS

In some of the Southern States a large variety of forage crops can be grown, but weather conditions during the harvest season cause improper curing and in some instances total loss of the crop. An experimental forage dryer has been installed on the Iberia Livestock Farm near Jeanerette, La., and tests are being made to determine some of the mechanical and economic factors involved in

artificial drying of such crops. Feeding tests were made with the artificially dried product to determine its nutrient value in comparison with field-cured forage. This project is being conducted in cooperation with the Bureaus of Animal Industry and Plant Industry.

DIRECT HARVESTING AND ARTIFICIAL DRYING OF RICE

The combined harvester-thresher has been used to a limited extent in harvesting rice in Arkansas, Louisiana, and Texas, but use of this machine has been successful only when accompanied by artificial drying of the threshed grain. The structure of the rice kernel is such that it may crack or rupture as a result, in part, of changes in temperature and moisture content. Tests were made during the 1930 harvest season to determine the maximum air temperature at which rice may be dried without injury to its milling properties. It was found that a temperature much in excess of 120° F. would cause appreciable injury. This work was conducted in cooperation with the grain division of the Bureau of Agricultural Economics.

SUGAR-BEET MACHINERY

The production of sugar beets involves much hard labor, under present practices, particularly in thinning the stand of young beets and in harvesting the crop, including removal of the tops before the beets are delivered to the sugar factory. The cost of these operations and the difficulties in seasonal employment of large amounts of labor have resulted in a demand from the growers for equipment that will reduce the labor requirements of this crop. Investigation of this subject was undertaken at the beginning of the fiscal year.

A blocking machine has been developed and tested in cooperation with the California and Colorado Agricultural Experiment Stations. The use of this implement has resulted in a saving of 25 per cent of the cost of hand labor in thinning beets. The three most distinctive types of beet harvesters also are being studied under field conditions in California and Colorado, in an effort to develop a more efficient machine for this purpose.

COTTON-PRODUCTION MACHINERY

The first year's work under this project has been of a preliminary nature, in analyzing the problems of cotton production with reference to the use of labor-saving machinery, in developing methods of research procedure, and in formulating plans for cooperative investigations. Projects have been established in cooperation with the Alabama and Mississippi experiment stations, dealing with methods of soil preparation, factors affecting planting and the final stand of cotton, methods of weed control, the use of labor-saving machinery, the control of large machine units on hillsides, and the efficiency of field machinery and mechanical cotton pickers.

Detailed research studies as to the factors affecting rolling resistance have been made with six wheels upon two soil types under different physical conditions. Definite correlations have been determined between the weight of wheel and the rolling resistance, the percentage of slip, and the depth to which the wheel sinks into the

soil. New correlations were made between the apparent specific gravity and moisture content of the soil and the rolling resistance of a wheel.

COTTON GINNING AND CONDITIONING

Wth funds appropriated by Congress for cotton ginning investigations, a cotton-ginning laboratory has been constructed and equipped at the Delta Branch Experiment Station, Stoneville, Miss. Cotton was first ginned at the laboratory in January, 1931. The studies there are for the purpose of improving cotton-ginning methods, and are carried on in cooperation with the Division of Cotton Marketing of the Bureau of Agricultural Economics. Several old cotton gins have been obtained, one built in 1844, and these will be used for purposes of comparison.

Approximately 1,000 tests were made during the year with cotton obtained from Georgia, Alabama, Mississippi, Missouri, and Texas. Complete soil and agronomic data were obtained for each lot of cotton. The tests covered various moisture conditions of the cotton, and various speeds of the saws from 300 to 1,000 revolutions per minute. Loose and tight rolls were obtained at each speed.

The tests so far indicate the necessity for a complete analysis of the fiber effects caused by present combinations of cleaners and extractors, and show the benefits to be derived from conditioning or drying seed cotton before it is ginned. Tests are being made to find a method of removing the green-leaf trash from cotton harvested with mechanical pickers.

A new type of cotton drier has been developed by the division for the use of growers who can not afford to buy the more expensive types. It has no moving parts and can be built at small expense.

MECHANICAL APPLICATION OF FERTILIZERS

Investigations of the mechanical application of fertilizers have been carried on cooperatively with the Bureau of Chemistry and Soils, the State experiment stations, the joint committee on fertilizer application, and the National Fertilizer Association.

Fertilizer-placement studies on cotton have been continued and expanded at the Pee Dee, Sandhill, and Clemson College experiment stations in South Carolina. Similar studies have been started in nine other representative cotton growing areas in the States of North Carolina, Georgia, Mississippi, Louisiana, Texas, Arkansas, and Oklahoma. The results to date indicate that highly significant differences in germination and yield result from different placements of the fertilizer in relation to the seed, when application is made at planting time. Disturbance of the soil below the seed in obtaining certain placements of the fertilizer is known to delay germination, particularly when rains do not immediately follow the planting. Irregular distribution of fertilizer gives somewhat lower yields than uniform distribution.

Cooperative fertilizer-placement studies have been started on canning crops, including sweet corn and beans, at Geneva, N. Y., and on potatoes in New Jersey, Ohio, and Michigan.

Two special machines for the fertilizer experimental work have been built under the general specifications of the division of agri-

cultural engineering. These machines apply the fertilizer and plant the seed simultaneously, giving accurate control of the application rate and placement of the fertilizer.

A laboratory in which the temperature and relative humidity of the air will be under control is under construction at Arlington Experiment Farm, Rosslyn, Va. The operation of various types of fertilizer distributors will be studied in the laboratory, and fundamental information will be obtained for use in the further development of distributing equipment.

FARM-LAND DEVELOPMENT

The experimental work on the use of poisons for killing trees and stumps was completed. The investigation brought out the fact that while many poisons may be used successfully for killing trees, arsenical poisons are most effective in hastening decay, and hence are best for use in land-clearing operations. Different species of trees show various degrees of resistance to the action of the poison; softwoods usually decay more rapidly than hardwoods. No sure method of killing stumps, effective on all species and under all conditions, was developed.

Methods of clearing land of brush and stones have been studied largely in cooperation with the University of Minnesota. A report has been prepared showing the comparative costs of clearing land on the four principal types of soil found in northern Minnesota. The data upon which this report is based were secured from records of operations carried on by 150 farmers and are given in sufficient detail to determine the number of man-hours and horse-hours, and the amount of explosives required for each operation involved in clearing and plowing land. Studies of soils producing heavy forest growth are being made to determine whether the crops that can be obtained from such soils are sufficiently larger than those from soil producing light timber to justify the greater cost of clearing the heavy timber.

The study in arranging farms for the most efficient production of crops, begun in 1930, has been continued. Each farm will be treated as a unit in which the cropping program, livestock, field arrangement, machinery, and buildings will all be properly coordinated. Cooperative projects along this line have been undertaken in North Carolina, Georgia, and Minnesota, and a number of farms have been surveyed in preparation for these studies. On 13 farms surveyed in North Carolina the average size of the field was 3.7 acres; on 20 farms in Georgia the average size was 5.6 acres; and on 11 farms in Minnesota the average size was 12.2 acres. The plans made for farms in North Carolina and Minnesota increase the average size of field to 10.8 and 28 acres, respectively. After the farmers have made the changes recommended, records will be kept to determine the increased income resulting.

FARM-STRUCTURE INVESTIGATIONS

SURVEY OF RESEARCH IN FARM STRUCTURES

This survey, for which the field work was nearly completed last year, made apparent the need for coordination of efforts. While

20 State experiment stations reported more than 50 projects as active, it seems that a large number of these are directed at securing comparative data on building problems in which there is a present and perhaps temporary interest. There has been a tendency toward duplication of effort in such phases of the field, while other phases equally or more important have been neglected. It appears that comparatively few accurate and basic data on the shelter factors which various farm buildings should furnish, or the best structural means of meeting those requirements, are being developed. Such information is needed to guide the judgment of owners and builders, who are continually striving to make new buildings more useful, economical, and convenient than those built previously.

The need for coordinated national and regional programs of research was made very evident. The State workers in this subject generally suggested that the Federal department take the lead in formulating such programs.

The report of the survey has been prepared for publication, and plans have been made for organization of all available agencies for effective conduct of the coordinated research program.

ORCHARD HEATERS

A preliminary study was made of the operation of oil-burning orchard heaters such as are in general use in California to prevent frost damage. The heaters tested were of the distilling type. This type produces smoke, particularly at high rates of combustion, and the clouds of smoke from large numbers of the heaters operating simultaneously is very objectionable to the aesthetic and economic interests of neighboring property owners. The object of the study was to determine the cause of excessive objectionable smoke arising from the heaters, and what preventive measures—such as proper selection of fuel or improvement in design of the heater—might be economically feasible. The data obtained have been analyzed and a report is in preparation.

CROP STORAGES

A study of the storage of corn and small grains in the Corn Belt was completed and a report prepared for publication. The need for increased facilities for farm storage has become important, because of economic changes in marketing and the growing use of machine harvesters. Structures satisfactory where hand husking is employed have proved inadequate in strength of buildings and in means of handling the crop with dispatch, when corn is harvested by machinery.

TEMPERATURES IN DAIRY BARNS

A study of the relation of stable air conditions to milk production was begun in cooperation with the Bureau of Dairying and with the agricultural college of the University of Wisconsin. The purpose is to determine the effect of sudden changes in stable temperatures on the production of milk by the cow of medium capacity, and the consequent necessity of insulation in the construction of dairy barns as a factor in temperature maintenance. The aim is also to determine the air conditions under which cows will produce the maximum

quantity of milk consistent with their health and comfort. The results of one season's observations are not considered conclusive, particularly as the winter was unusually mild, and the study is to be continued.

SERVICE WORK

The value of the services that have been rendered to other bureaus of the department is made evident by the greatly increasing demands for assistance of varied character. Work of this nature performed during the past year has included the preparation of plans and specifications as follows:

For the animal husbandry experiment farm at Beltsville, Md., a 3-story poultry laboratory building and a building for housing small animals employed in zoological investigations.

For the Arlington Experiment Farm at Rosslyn, Va., a combined drug-plant laboratory and storage building, a threshing shed, a building for experimental work on fertilizer machinery, and two headhouses.

For the Bureau of Plant Industry at Guayama, P. R., a laboratory and an office building.

For this bureau and the Bureau of Agricultural Economics, a cotton-ginning laboratory erected at the Delta Branch Experiment Station, Stoneville, Miss.

For the National Zoological Park, cold-storage rooms, remodeling of the general heating system, and an eagle flight cage.

For the extensible building of the department, now under construction; a refrigerating plant, vacuum pumps, air compressors, etc.

Also, specifications were prepared for a number of refrigerating, heating, plumbing, and electrical installations at field experiment stations of the Department of Agriculture, and plans for an equipment depot to be erected at Ogden, Utah, for the use of the Bureau of Public Roads in storing and caring for road-building equipment.

Designs for a cheese factory and three creameries were prepared for general distribution.

The division supervised the construction and preliminary operation of the Bear River Migratory-Bird Refuge established by the Bureau of Biological Survey in Box Elder County, Utah, which was nearing completion at the end of the fiscal year. It also supervised construction of a dam and irrigation layout constructed near Cheyenne, Wyo., for the Bureau of Plant Industry.

Service is being rendered to the Bureau of Biological Survey in collection and compilation of data on water rights acquired or to be acquired for the Malheur Lake Bird Refuge in Oregon; to the War Department in the appraisal of lands and acquisition of flowage rights for the Mississippi River flood-control project; and to the State Department in estimating damages that would be caused to lands along Kootenai River in Idaho by the construction of a proposed power development in British Columbia.

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REPORT OF THE CHIEF OF THE BUREAU OF PUBLIC ROADS

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF PUBLIC ROADS,
Washington, D. C., September 1, 1932.

SIR: I submit herewith the report of the Bureau of Public Roads for the fiscal year ended June 30, 1932.

Respectfully,

THOMAS H. MACDONALD,
Chief of Bureau.

Hon. ARTHUR M. HYDE,
Secretary of Agriculture.

The record of Federal-aid road construction in the fiscal year 1932 is distinguished by the addition of a greater mileage of improved roads than in any previous year. The 15,997 miles on which improvements were completed is nearly a sixth of the total mileage improved with Federal aid during the entire period since the passage of the Federal-aid road act in 1916.

Similar report may be made of the year's work in improvement of the national-forest highways. In both cases the great increase in mileage of improvements completed is mainly the realization of the results of the increased appropriations that have been authorized since 1930. In the Federal-aid work the result was also influenced strongly by action taken in the same year to relieve unemployment.

THE EMERGENCY ADVANCE APPROPRIATION AND EMPLOYMENT

On December 20, 1930, the President approved an appropriation of $80,000,000, to be apportioned among the 48 States and Hawaii in the manner prescribed for the apportionment of Federal aid, to be used by the States to match the regular Federal-aid funds available. The fund was made available only for expenditure on work actually completed by September 1, 1931, and it was stipulated that the amounts actually expended by each of the States were to be reimbursed to the Federal Treasury by deduction from anticipated future Federal-aid apportionments over a period of five years beginning with the fiscal year 1933. This was an emergency measure to supply deficiencies of State revenue and permit increased employment on road work during the early road-building season of 1931.

Partial report on the expenditure of this appropriation was made in my annual report for the fiscal year 1931, but it was not possible at that time to report finally upon the expenditure or its effects.

The final auditing of all vouchers for work done has since been completed, and it has been determined that the actual total expenditure upon Federal-aid roads was $79,203,719.20. The distribution of this expenditure by States and the corresponding State apportionments are shown in Table 1.

142625—32——1

TABLE 1.—*Emergency advance-fund apportionment and the final statement of the amounts paid to the States for work done to August 31, 1931*

State	Apportionment of $80,000,000 emergency advance fund, under the act of Dec. 20, 1930	Final statement of the amounts paid to the States for work done to Aug. 31, 1931	State	Apportionment of $80,000,000 emergency advance fund, under the act of Dec. 20, 1930	Final statement of the amounts paid to the States for work done to Aug. 31, 1931
Alabama	$1,698,645	$1,692,051.39	New Hampshire	$400,000	$400,000.00
Arizona	1,170,481	1,170,481.00	New Jersey	1,107,807	1,107,807.00
Arkansas	1,388,157	1,388,157.00	New Mexico	1,303,288	1,303,288.00
California	3,108,233	3,008,827.35	New York	4,050,566	4,050,566.00
Colorado	1,507,832	1,507,832.00	North Carolina	1,926,775	1,926,775.00
Connecticut	520,491	520,491.00	North Dakota	1,298,532	1,298,532.00
Delaware	400,000	400,000.00	Ohio	2,998,538	2,998,538.00
Florida	1,086,438	1,086,438.00	Oklahoma	1,926,351	1,926,351.00
Georgia	2,077,996	2,077,996.00	Oregon	1,320,287	1,299,211.00
Idaho	1,008,035	1,008,035.00	Pennsylvania	3,512,943	3,512,943.00
Illinois	3,400,116	3,400,116.00	Rhode Island	400,000	400,000.00
Indiana	2,045,929	2,045,929.00	South Carolina	1,114,636	1,114,636.00
Iowa	2,116,369	2,116,369.00	South Dakota	1,337,973	1,337,973.00
Kansas	2,192,301	2,192,301.00	Tennessee	1,741,882	1,741,882.00
Kentucky	1,504,715	1,504,715.00	Texas	5,088,080	4,883,760.81
Louisiana	1,147,927	987,776.65	Utah	926,521	925,708.57
Maine	715,799	715,799.00	Vermont	400,000	400,000.00
Maryland	678,752	678,752.00	Virginia	1,505,502	1,505,502.00
Massachusetts	1,141,460	1,141,460.00	Washington	1,270,933	1,270,933.00
Michigan	2,521,382	2,521,382.00	West Virginia	875,384	875,384.00
Minnesota	2,249,993	2,249,993.00	Wisconsin	1,992,410	1,992,410.00
Mississippi	1,434,736	1,434,736.00	Wyoming	1,029,383	1,029,383.00
Missouri	2,526,823	2,367,575.60	Hawaii	400,000	400,000.00
Montana	1,671,930	1,671,930.00			
Nebraska	1,708,031	1,708,031.00	Total	80,000,000	79,203,719.20
Nevada	1,049,638	904,961.83			

The effect of this appropriation upon employment in highway work is shown in Table 2, which lists the average number of men directly employed by months on various classes of Federal and State work. The table shows that in January, 1931, the first month after the appropriation of the emergency funds, total direct road employment on all classes of work administered by the Federal and State Governments averaged 148,600 men. Federal-aid construction employed directly in that month only 30,944 men, other classes of Federal work only 335 men, and State construction and maintenance operations only 117,321 men.

TABLE 2.—*Average number of persons employed directly on various classes of road work under the supervision of Federal and State agencies, by months, January, 1931, to June, 1932, inclusive*

Month	Persons employed on construction of roads						Persons employed on maintenance of roads by States	Total persons employed
	National-forest roads	National-park roads	Federal-aid roads	Total Federal and Federal aid	State and State aid	Total on construction		
1931								
January	228	107	30,944	31,279	48,621	79,900	68,700	148,600
February	548	172	36,867	37,587	53,787	91,374	80,186	171,560
March	1,278	172	53,402	54,852	58,701	113,553	91,334	204,887
April	2,663	350	94,547	97,560	72,212	169,772	93,732	263,504
May	3,808	1,002	121,905	126,715	89,764	216,479	94,452	310,931
June	4,722	2,168	147,625	154,515	101,275	255,790	107,692	363,482
July	6,617	2,625	155,466	164,708	112,638	277,346	108,003	385,349
August	6,219	2,895	142,304	151,418	121,172	272,590	117,359	389,949
September	6,048	3,189	106,863	116,100	123,404	239,504	117,113	356,617
October	5,183	2,842	80,844	88,869	116,752	205,621	124,483	330,104
November	3,550	2,054	56,862	62,466	103,198	165,664	123,652	289,316
December	1,193	920	33,878	35,991	74,543	110,534	134,437	244,971
1932								
January	888	528	28,102	29,518	58,590	88,108	141,081	229,189
February	649	440	25,584	26,673	53,607	80,280	137,938	218,218
March	644	448	26,916	28,008	50,699	78,707	132,842	211,549
April	1,243	497	40,465	42,205	62,056	104,261	141,582	245,843
May	1,763	634	56,611	59,008	70,834	129,842	129,773	259,615
June	2,386	1,341	68,045	71,772	79,845	151,617	129,019	280,636

This was a lower level of employment than has existed at any time since. It was due primarily to the exhaustion of State highway revenues during the preceding active construction season and to the fact that State revenues for the new year were not yet available in a large number of States. It was this condition that the emergency advance was designed to correct, and the rapid increase in direct employment on Federal-aid work up to the peak of 155,466 men, reached in July, 1931, is evidence of the degree to which the desired result was obtained. In very large part this rapidly increasing employment on Federal-aid construction in the spring and early summer of 1931 was financed with regular Federal-aid funds and the Federal funds advanced to match them.

The effect of the time limit set on the utilization of the funds advanced is shown by the decline in Federal-aid employment after July, 1931. In September, when the advance funds were no longer available, employment dropped sharply to 106,863, and the drop continued to midwinter, 1932. This does not mean, however, that the Federal emergency measure was not effective after September, 1931. On the contrary it is certain that much of increased employment provided by the States in the winter of 1931–32 was made possible by the substitution of Federal advance funds for regular State funds in early-season work and the saving of the States' own funds for expenditure during the cold months.

While employment on Federal and Federal-aid road work was considerably less during the last winter and spring than in the corresponding seasons a year before, the States were able to maintain employment on independent State work considerably above the level of the previous year until June. Their ability to do so was an indirect consequence of the Federal advance which permitted the saving of State funds for later expenditure than would ordinarily have been possible.

As shown by Table 2, a large part of the total highway employment provided during the last winter was on maintenance work administered by the States. The increase in the amount of such employment, shown by comparison with the statistics for the previous year, is evidence of the special effort made to aid the unemployed.

PROGRESS IN FEDERAL-AID ROAD CONSTRUCTION

Initial improvements were completed during the fiscal year on 11,036.9 miles of the Federal-aid highway system; advanced stages of construction were completed on 4,925.1 miles; and 35.2 miles previously improved were reconstructed. The total mileage upon which improvements were completed was therefore 15,997.2 miles. This exceeds by more than 4,000 miles the mileage completed in any previous year; and it is desired to emphasize that these improvements, classed as completed, were not only physically completed but had also been paid for by the Federal Government to the full extent of its obligation.

In addition to these projects, there were others on which at the end of the year all improvements were physically completed in a manner which the bureau was willing to approve, and only the final payment of Federal money remained to discharge the Government's full obligation. In accordance with the practice begun last year these projects are separately classified because, until the final voucher has been paid, it is not possible to report exactly the total cost and Federal payment.

In projects of this class there were at the end of the fiscal year 2,269.5 miles of initial construction, 652.1 miles of stage construction, and 9.3 miles of reconstruction, a total of 2,930.9 miles.

At the close of the year construction of initial improvements was in progress on 7,885.4 miles, and other initial improvements had been approved for 2,110.9 miles. Stage construction was in progress on 2,616 miles already initially improved with Federal aid and similar advanced improvements had been approved for 1,951.6 miles. In addition, 10.5 miles previously improved were in process of reconstruction and projects for the reconstruction of 13.7 miles had been approved.

The total mileage on which initial improvements had been completed and final payment made by the Federal Government up to the end of the fiscal year 1932 was 101,389.1. In addition, there were 2,269.5 miles which were physically completed and opened to traffic but not yet completely paid for on the part of the Federal Government. Initial improvements had, therefore, been physically completed with Federal aid on 103,658.6 miles of the system on June 30. At that time, however, 2,626.5 miles included in the above were undergoing stage construction or reconstruction and were temporarily removed from the mileage open to travel, so that the bureau classifies as completed on June 30, 1932, only 101,032.1 miles, a net increase of 12,319 miles over the corresponding mileage

on June 30, 1931. The location of this mileage by States is shown in Table 16. Its classification by types, as built with Federal aid, and its location is shown in Table 21.

STAGE CONSTRUCTION

The steady increase in the ratio of stage construction to initial construction, to which attention has been directed in several previous annual reports, continued during the past year. Although the mileage of initial improvements completed and paid for was the greatest ever recorded in a single year, the stage construction completed increased in greater proportion. The 4,925.1 miles completed represented 44.6 per cent of the mileage of initial construction completed, as compared with 38.8 per cent, the corresponding ratio of the year immediately preceding. By reference to Table 3 it will be seen that this ratio has grown steadily since it was first recorded in 1923, when it was only 1.2 per cent.

TABLE 3.—*Mileage of initial construction, stage construction, and reconstruction completed and final payment made, by fiscal years, 1923–1932, inclusive*

Fiscal year	Mileage of initial construction completed and paid for	Stage construction completed and paid for		Reconstruction completed and paid for		Mileage of total construction
		Mileage	Percentage of initial construction	Mileage	Percentage of initial construction	
1923	9,940.5	117.8	1.2			10,058.3
1924	9,145.6	280.7	3.1			9,426.3
1925	9,437.1	495.3	5.3			9,932.4
1926	10,533.3	783.9	7.4			11,317.2
1927	8,413.5	1,376.6	16.4			9,790.1
1928	8,532.2	2,088.8	24.5			10,621.0
1929	7,267.4	2,069.7	28.5			9,337.1
1930	6,675.4	1,988.0	29.8	18.8	0.3	8,682.2
1931	7,938.8	3,082.5	38.8	12.0	.2	11,033.3
1932	11,036.9	4,925.1	44.6	35.2	.3	15,997.2

As previously explained, works classified as stage construction are supplementary improvements, paid for in part with Federal aid, of roads previously improved to lesser degree as Federal-aid projects. In most instances it is work deliberately deferred at the time of original improvement, and definitely forecast and agreed upon as a future necessity in the original agreements with the States. Many such projects involve the deferred surfacing of roads previously graded and drained. The additional Federal aid allotted does not in any case raise the total Federal expenditure on the project beyond the limit per mile fixed by the law.

Such work is deferred in the first instance mainly for the reason that it is desired to extend the benefits of some degree of improvement as rapidly as the limited annual funds will permit to all parts of the system, and a form of improvement less complete than that regarded as ultimately desirable may be tolerated for a short time in view of the partial benfits conferred.

The increase in the amount of the supplementary work from year to year is the natural result of the shrinkage of unimproved mileage within the system and the development of the occasion and the opportunity for further improvement of the previously improved mileage.

Detailed information in regard to stage construction completed, in progress, and approved will be found in Tables 17 to 20 and 26 to 29. The mileage of improvement classified as graded and drained in Tables 26 to 29 consists almost wholly of partial relocations of previously improved roads on which surfacing has not yet been added. The relocations are in nearly all instances occasioned by the necessity of reducing curvature of the original improvements in consequence of the increased speed of traffic.

The effect of stage construction as a means of raising the standard of improvement of the system is evident from a comparison of Tables 22 and 30, the former showing the mileage of the several types of construction completed as initial improvements during the past year and the latter the net change in the character of the total improved mileage as influenced by stage construction. It will be seen

that the net addition of mileage of the several types is greater than the year's initially improved mileage in the case of the higher types and less in the case of the lower types.

EFFECT OF SUBSEQUENT UNAIDED IMPROVEMENTS

All the works referred to above as stage construction are supplementary improvements made with Federal financial assistance on roads previously improved with Federal aid. In addition to the betterments thus made with Federal help the State highway departments have independently made similar improvements of the roads initially improved with Federal aid.

The volume of such work is not so great as that of the Federally aided stage construction and, since there is no Federal participation its results have not been previously reported by this bureau. The mileage affected by such work has now grown, however, to nearly 20,000 miles, and it is thought desirable to report the character and amount of it to date and the effect that it has had on the general character of the roads on which Federal aid has been granted. The mileage on which independent State work of this character has been completed up to June 30, 1932, is shown in Table 4 classified by types of construction. A type comparison of the total mileage on which Federal aid has been granted, as improved with Federal assistance and as such improvements have been modified by independent State construction is furnished by Table 5. It will be apparent that the independent State work has an effect similar to that of the Federal-aid stage construction and tends further to elevate the standard of improvement of the system as a whole.

TABLE 4.—*Net changes in mileage of the types of Federal-aid projects on which additional improvements have been made by the States without Federal participation, June 30, 1932*

Types as improved with Federal aid	Miles of roads of indicated types as further improved by the States without Federal aid											
	Graded and drained	Sand-clay, and topsoil		Gravel		Macadam, treated	Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Total
		Untreated	Treated	Untreated	Treated							
Graded and drained	-----	1,053.8	109.9	2,579.4	1,566.8	159.5	523.1	105.0	111.1	1,519.0	18.2	7,745.8
Sand-clay and topsoil, untreated	-----	-----	683.5	96.3	70.6	-----	161.2	48.9	174.5	532.8	----	1,767.8
Gravel, untreated	[1] 39.9	-----	-----	-----	5,618.7	68.5	1,351.8	168.3	340.0	1,201.7	15.6	8,804.5
Gravel, treated	-----	-----	-----	-----	-----	-----	14.9	----	15.1	4.4	----	34.4
Macadam, untreated	-----	-----	-----	-----	-----	1,092.6	20.9	29.2	51.9	11.7	----	1,206.3
Macadam, treated	-----	-----	-----	-----	-----	-----	22.9	2.7	18.6	1.8	----	46.0
Low-cost bituminous mixture	-----	-----	-----	-----	-----	-----	-----	-----	-----	3.9	----	3.9
Bituminous macadam	-----	-----	-----	-----	-----	-----	-----	-----	43.3	26.8	----	70.1
Bituminous concrete	-----	-----	-----	-----	-----	-----	-----	-----	-----	17.8	----	17.8
Portland cement concrete	-----	-----	-----	-----	-----	-----	-----	-----	105.6	-----	35.3	140.9
Block	-----	-----	-----	-----	-----	-----	-----	-----	5.3	1.3	----	6.6
Total	39.9	1,053.8	793.4	2,675.7	7,256.1	1,320.6	2,094.8	354.1	865.4	3,321.2	69.1	19,844.1

[1] Relocations not yet surfaced.

TABLE 5.—*Type classification of Federal-aid roads as improved with Federal aid, and as modified by subsequent improvements by the States without Federal aid, June 30, 1932*

Type	Federal-aid improvements by types		Actual existing mileage by types due to further improvements by the States	
	Mileage	Per cent of total	Mileage	Per cent of total
Graded and drained	12,222.4	12.1	4,516.5	4.5
Sand-clay and topsoil, untreated	7,395.8	7.3	6,681.8	6.6
Sand-clay and topsoil, treated	36.0		829.4	.8
Gravel, untreated	30,545.9	30.2	24,417.1	24.2
Gravel, treated	862.8	.9	8,084.6	8.0
Macadam, untreated	1,983.5	2.0	777.2	.7
Macadam, treated	916.4	.9	2,191.0	2.2
Low-cost bituminous mixtures	3,532.2	3.6	5,673.0	5.6
Bituminous macadam	4,468.2	4.4	4,752.2	4.7
Bituminous concrete	3,841.6	3.8	4,689.2	4.6
Concrete	33,671.6	33.3	36,851.9	36.5
Block	1,021.5	1.0	1,084.0	1.1
Bridges and approaches	484.2	.5	484.2	.5
Total	101,032.1	100.0	101,032.1	100.0

Its effect is especially noticeable in the surfacing of graded and drained roads and the surface treatment of roads constructed with Federal aid as plain water-bound macadam, gravel, and sand-clay roads.

As previously indicated, the Federal-aid projects under which improvement is limited to grading and drainage are approved subject to definite agreement on the part of the States to lay surfaces adequate for the traffic as early as possible either with or without additional Federal aid. Such of the roads involved as are subsequently surfaced without Federal aid remain in the official records of this bureau, which refer only to work done with Federal participation, as graded and drained roads, and the record, therefore, does not accurately reflect the true existing condition. Thus Table 5 shows that of the 12,222.4 miles which remain in the bureau's records as graded and drained with Federal aid, there are only 4,516.5 miles that actually are still unsurfaced, more than 7,700 miles having been subsequently surfaced by the States without Federal participation. The 4,516.5 miles actually remaining unsurfaced is less than the mileage of that type constructed with Federal aid in the last two years.

There is a similar situation in respect to the roads constructed with Federal aid as water-bound macadam and so classified in the bureau's records. Under modern conditions there are few cases in which a plain water-bound macadam surface is adequate. In nearly all cases such roads require surface treatment with bituminous material or other protection to prevent damage by motor vehicles. But such treatments can not ordinarily be applied until the plain water-bound surface has passed through a season of curing to acquire firmness under traffic.

Wherever, in the judgment of the bureau, such treatment is required the construction of a water-bound macadam surface is approved only upon the definite understanding that it will be surface-treated either with or without Federal aid at the proper time. In the interim, however, the project remains on the bureau's records as water-bound macadam; and if the treatment is applied without Federal aid the original project remains permanently in the Federal records as of the original type. This, as previously explained, is because the bureau's records reflect only the amount and character of work done with Federal aid. Table 5 also shows that the roads classified in the bureau's official record as untreated water-bound macadam have a length of 1,983.5 miles, whereas the mileage of that type built with Federal aid and actually remaining untreated on July 30, 1932 was only 777.2 miles, the rest having been treated independently by the States. The remaining untreated mileage is slightly greater than the untreated mileage completed in the last two fiscal years.

RECONSTRUCTION

Reconstruction was completed during the year and final payment was made therefor on a total of 35.2 miles of Federal-aid roads constructed in previous years. In addition there were 9.3 miles upon which reconstruction was physi-

cally complete at the end of the year but which had not been fully paid for by the Federal Government.

Full information in regard to reconstruction of Federal-aid projects will be found in Tables 6 to 12 and 17 to 20.

TABLE 6.—*Federal-aid projects on which reconstruction had been completed and paid during fiscal year 1932*

State	Total cost	Federal aid	Miles
Maryland	$832,258.64	$329,771.88	13.5
Michigan	590,274.81	150,030.00	10.0
Nevada	268,290.65	170,463.14	9.2
Oklahoma	57,578.68	25,000.00	2.5
Total	1,748,402.78	675,265.02	35.2

TABLE 7.—*Federal-aid projects on which reconstruction had been completed, but final payment not made, June 30, 1932*

State	Estimated total cost	Federal aid allotted	Miles
Michigan	$189,000.00	$93,345.00	6.1
Oklahoma	101,693.62	37,846.59	3.2
Total	290,693.62	131,191.59	9.3

TABLE 8.—*Federal-aid projects on which reconstruction was in progress June 30, 1932*

State	Estimated total cost	Federal aid allotted	Miles
Oklahoma	$185,963.65	$102,767.15	8.3
Rhode Island	81,305.62	40,652.81	2.2
Total	267,269.27	143,419.96	10.5

TABLE 9.—*Federal-aid projects by types of construction on which reconstruction had been completed June 30, 1932*

State	Age (years)	Original type							
		Gravel, untreated		Bituminous macadam		Bituminous concrete		Portland-cement concrete	
		New type	Miles	New type	Miles	New type	Miles	New type	Miles
Louisiana	4	Bituminous concrete.	7.5						
Maine	7			Concrete	1.9				
Do	9			do	1.6				
Maryland	13			do	5.1				
Do	11			do	6.5				
Do	13			Bituminous concrete.	2.6				
Do	13							Concrete	5.8
Massachusetts	10					Bituminous macadam.	2.6		
Do	8			Concrete	2.8				
Michigan	12					Concrete	10.0		
Do	10	Concrete	6.1						
Nevada	13							Bituminous concrete.	9.2
New Hampshire	12					Concrete	1.2		
Do	12					do	.5		
Do	10					do	2.0		
Oklahoma	11	Concrete	2.5						
Do	9	do	2.7						
Do	11	do	3.2						
Do	9	Bridges	.1						
Vermont	5	Concrete	1.4						

TABLE 10.—*Federal-aid projects, by types of construction, on which reconstruction had been completed and paid for during the fiscal year 1932*

State	Age (years)	Original type							
		Gravel, untreated		Bituminous macadam		Bituminous concrete		Portland-cement concrete	
		New type	Miles	New type	Miles	New type	Miles	New type	Miles
Maryland	13			Bituminous concrete.	2.6				
Do	13			Concrete	5.1				
Do	13							Concrete	5.8
Michigan	12					Concrete	10.0		
Nevada	13							Bituminous concrete.	9.2
Oklahoma	11	Concrete	2.5						

TABLE 11.—*Federal-aid projects, by types of construction, on which reconstruction had been completed, but final payment not made, June 30, 1932*

State	Age (years)	Original type—gravel, untreated	
		New type	Miles
Michigan	10	Portland cement concrete	6.1
Oklahoma	11	do	3.2

TABLE 12.—*Federal-aid projects, by types of construction, on which reconstruction was in progress June 30, 1932*

State	Age (years)	Original type			
		Gravel, untreated		Bituminous macadam	
		New type	Miles	New type	Miles
Oklahoma	11	Concrete	8.3		
Rhode Island	13			Concrete	2.2

CHANGES IN THE FEDERAL-AID HIGHWAY SYSTEM

In the last annual report the mileage of the Federal-aid system within the boundaries of national forests, Indian reservations, and other Federal reservations was reported as 5,580.07 miles, as determined up to the close of the fiscal year 1931. During the past year further determinations have increased this mileage to 5,785.19, located, by States, as shown in Table 13.

TABLE 13.—*Mileage of Federal-aid highway system within Federal reservations, being the amounts by which the 7 per cent limiting mileage may be exceeded in each State*

State	Mileage within Federal reservations	State	Mileage within Federal reservations	State	Mileage within Federal reservations
Arizona	547.20	Minnesota	74.80	Pennsylvania	108.21
Arkansas	119.70	Mississippi	10.40	South Dakota	474.50
California	457.00	Montana	920.92	Tennessee	66.04
Colorado	423.50	Nebraska	11.25	Utah	68.90
Georgia	57.80	Nevada	21.77	Virginia	30.72
Idaho	468.40	New Hampshire	33.42	Washington	439.66
Illinois	4.50	New Mexico	368.88	West Virginia	29.06
Iowa	2.00	New York	16.47	Wisconsin	45.50
Kansas	14.70	North Carolina	176.34	Wyoming	325.90
Kentucky	6.00	North Dakota	23.39		
Maine	4.50	Oklahoma	16.25	Total	5,785.19
Michigan	57.41	Oregon	360.10		

Under the amendment of the Federal highway act approved May 21, 1928, the original 7 per cent system in the several States may be increased by these mileages within Federal reservations, and such addition, together with an increase in the mileage of the system in Hawaii authorized by a special act approved February 23, 1931, raises the permissible mileage of the initial system to 206,666 miles. The act mentioned set aside the 7 per cent limitation upon the initial system with respect to Hawaii and authorized the selection of a system on which Federal-aid apportionments to the Territory shall be expended by agreement between the Governor of the Territory and the Secretary of Agriculture. The former 7 per cent limitation for Hawaii was 213 miles. This limitation is abolished, and under authority of the act above mentioned the Secretary of Agriculture and Governor of Hawaii have agreed upon a system embracing 532 miles.

By addition to the system during the past year, made possible in part by the provisions of the amendment of May 21, 1928, and in part by the change in Hawaii, the mileage of the initial system has been increased to 196,677 miles. This mileage has been further increased by extension of the system in seven States in which the initial 7 per cent system has been improved to the satisfaction of the Secretary of Agriculture. The States in which such extensions have been approved are: Connecticut, in which the extension is 118.37 miles; Delaware, 408.72 miles; Maryland, 921.29 miles; Massachusetts, 49.72 miles; New Jersey, 165.23 miles; New York, 1,373.59 miles; and Rhode Island, 298.20 miles. The sum of these extensions, 3,335.12 miles, added to the initial system thus far designated, raises the mileage of the total system to 200,013 miles as of June 30, 1932, an increase of 3,136 miles in the last year.

The mileage of the designated Federal-aid system in each State, including the authorized extensions in the seven States mentioned and the mileage within Federal reservations, is given in Table 16, which also shows the distribution, by States, of the 101,032.1 miles classified as completed on June 30, 1932.

The mileage classified as completed with Federal aid still includes some roads improved before 1921 and not since included in the designated Federal-aid system. These roads, if found not sufficiently important to be added to the designated system, are being gradually dropped and the Federal money invested in them transferred as a credit to the improvement of other roads in the system.

A year ago it was reported that the Federal aid originally paid for the improvement of 1,011.3 miles of such roads outside the system had been transferred to other roads within the system. Continuation of this procedure during the past year has returned to the Government the amount originally expended on other roads outside the system totaling 300 miles, and this money has been allotted to the initial or stage construction of other roads within the system.

The mileage classified as improved has also been reduced this year, by reductions in the length of previously improved roads by relocations effected in stage construction and by correction of records, in the amount of 103 miles.

CONSTRUCTION OF ROADS THROUGH PUBLIC LANDS AND FEDERAL RESERVATIONS

The emergency employment act of December 20, 1930, appropriated $3,000,000 to be expended for the survey, construction, reconstruction, and maintenance of main roads through unappropriated or unreserved public lands, nontaxable Indian lands, or other Federal reservations except national forests. The Secretary of Agriculture had previously been authorized, by act approved June 24, 1930, to cooperate in such work with State highway departments and the Department of the Interior.

After deduction of the 2½ per cent administrative allowance the balance of the $3,000,000 appropriation, amounting to $2,925,000 was apportioned among 13 States having more than 5 per cent of their area in lands of the kind described. The apportionment was made in the proportion that the area of such lands in each State bears to their total area in all States, as required by law.

The sums apportioned to the several eligible States and the status of expenditure are shown in Table 14.

TABLE 14.—*Status of appropriation for roads through public lands and Federal reservations June 30, 1932*

State	Sum apportioned	Sums allotted to projects—				
		Not yet under construction	Under construction	Completed and finally inspected	Completed and final payment made	Total
Arizona	$416,328		$173,972.91	$242,355.09		$416,328
California	230,614	$230,614.00				230,614
Colorado	130,197		130,197.00			130,197
Idaho	174,316			101,200.93	$73,115.07	174,316
Montana	164,521	37,245.93			127,275.07	164,521
Nevada	588,914	12,351.84	576,562.16			588,914
New Mexico	256,790		195,343.60	61,446.40		256,790
Oklahoma	41,464	11,028.77	30,435.23			41,464
Oregon	193,377	10,400.00	182,977.00			193,377
South Dakota	65,715		65,715.00			65,715
Utah	326,683	18,095.58			308,587.42	326,683
Washington	55,165				55,165.00	55,165
Wyoming	280,916		126,608.60		154,307.40	280,916
Total	2,925,000	319,736.12	1,481,811.50	405,002.42	718,449.96	2,925,000

By June 30, 1932, as shown by Table 14, the entire sum apportioned had been allotted to definite road-construction projects, including surveys in a few instances. Projects involving more than $1,100,000 had been completed; others involving nearly $1,500,000 were under construction; and the balance of nearly $320,000 had been allotted to projects that were not yet under construction.

FEDERAL-AID FUNDS APPORTIONED, OBLIGATED, AND EXPENDED

The Federal-aid appropriation authorized for the fiscal year 1932 was $125,000,000. The balance of $121,875,000 remaining after deduction of 2½ per cent allowed for administration was apportioned by the Secretary of Agriculture on September 1, 1930. The amounts credited to the several States are shown in Table 31.

On July 1, 1931, at the beginning of the fiscal year, the unobligated balance of all funds previously apportioned, including the sum apportioned for 1932, was $39,638,888.04. This indicates that there had been obligated to projects at the beginning of the fiscal year the equivalent of all funds apportioned for prior fiscal years and more than $82,000,000 of the funds for the new fiscal year.

On October 15, 1931, the appropriation authorized for the fiscal year 1933 was apportioned. In this apportionment the amounts regularly due the several States were reduced as required by law by the amount of the first of five annual deductions on account of the emergency advance of $80,000,000 made during the preceding fiscal year.

The act appropriating the emergency funds provided for reimbursement by deduction of the amounts actually expended by each of the States from their respective apportionments of future Federal-aid authorizations over a period of five years beginning with the fiscal year 1933. When the apportionment of the 1933 funds was made it was not possible to determine precisely how much of the emergency funds advanced to them had been actually expended because of the normal delay in submission of vouchers. Therefore, in determining the amounts of the 1933 funds due the States, deductions were made from the amounts that would have been regularly apportioned to them equal to one-fifth of the emergency funds advanced to them, with the proviso that if it should be found that any State had failed to expend the entire amount of emergency funds advanced to it, a revision of the apportionment would be made.

The total appropriation authorized for the fiscal year 1933 was $125,000,000. After deduction of the 2½ per cent allowed for administration and one-fifth of the $80,000,000 advance, the balance available for apportionment was $105,875,000. This amount added to the $39,638,888.04 unobligated at the beginning of the fiscal year 1932 increased the sum available for allotment to projects during the year to $145,513,888.04.

The amount obligated during the fiscal year was $83,793,787.44 and the balance unobligated on June 30, 1932 was $61,720,100.60. The amount actually paid to the States during the fiscal year was $127,367,119.74. By reference to Table 15 it will be seen that the amount obligated during the fiscal year 1932 was little more than half of the sum obligated during the preceding year. The amount expended was only slightly less than the previous year's expenditure.

TABLE 15.—*Federal-aid funds apportioned to the States, obligated to projects and paid to the States each fiscal year, 1923 to 1932, inclusive*

Fiscal year	Apportioned amount of appropriation authorized for the year	Amount of Federal-aid funds obligated during the year	Amount of Federal-aid funds paid to States during the year
1923	$48,750,000	$77,461,559	$69,677,241.86
1924	63,375,000	89,866,864	79,217,397.90
1925	73,125,000	87,294,396	95,749,998.11
1926	73,125,000	79,608,897	87,754,534.57
1927	73,125,000	77,453,046	81,371,013.03
1928	73,125,000	88,922,185	80,802,232.55
1929	73,125,000	70,428,896	82,097,380.38
1930	73,125,000	102,498,084	75,880,862.84
1931	121,875,000	157,952,903	133,340,910.64
1932	121,875,000	83,793,787	127,367,119.74
Total	[1] 794,625,000	915,280,617	[1] 913,258,691.62
Average	79,462,500	91,528,062	91,325,869.16

[1] The excess of total payments over total apportionments for these years was possible because from 1917 to 1922, inclusive, the appropriations exceeded the payments by more than an equal amount.

COST OF THE ROADS

The total cost of the 11,036.9 miles of initial construction, the 4,925.1 miles of stage construction, and the 35.2 miles of reconstruction completed and completely paid for during the year was $317,216,271.78, of which the Federal Government paid $144,720,610.07, or 45.6 per cent, and the States the balance. These expenditures were made over the period required to construct the roads, and additional expenditures were made during the same period for other projects under construction and not yet completed.

As previously stated, the total of Federal funds disbursed during the year on all active projects was $127,367,119.74, as shown in Table 31. Of this sum, 1 State, New York, received more than $11,000,000; 1, Texas, received more than $8,000,000; 3, California, Illinois, and Pennsylvania, received more than $5,000,000; 3, Indiana, Michigan, and Ohio, received more than $4,000,000; and 5, Georgia, Kansas, Minnseota, Montana, and Nebraska, received more than $3,000,000. With the exception of 6 States—Delaware, Maryland, New Hampshire, New Jersey, Rhode Island, and Vermont, and the Territory of Hawaii—every State received for work done during the year in excess of $1,000,000.

FEDERAL-AID STATISTICS

Statistical information relative to the apportionment, obligation, and disbursement of Federal aid during the fiscal year 1932, the cost of roads completed, the estimated cost of roads under construction, and the types of roads completed and under construction, etc., is given in Tables 16 to 31, inclusive.

TABLE 16.—*Mileage of the designated Federal-aid highway system in each State, and mileage improved with Federal aid to June 30, 1932*

State	Mileage of designated Federal-aid highway system	Mileage completed with Federal aid to June 30, 1932	State	Mileage of designated Federal-aid highway system	Mileage completed with Federal aid to June 30, 1932
Alabama	3,931	2,393.9	New Hampshire	988	421.0
Arizona	1,979	1,220.1	New Jersey	1,364	616.5
Arkansas	4,953	1,960.2	New Mexico	3,616	2,250.1
California	4,889	2,328.6	New York	7,121	3,273.4
Colorado	3,584	1,603.2	North Carolina	4,355	2,226.4
Connecticut	958	281.7	North Dakota	7,439	5,062.7
Delaware	675	345.7	Ohio	5,914	2,858.4
Florida	1,912	638.0	Oklahoma	5,982	2,295.2
Georgia	5,610	3,068.4	Oregon	3,247	1,522.8
Idaho	3,116	1,460.3	Pennsylvania	6,374	3,012.6
Illinois	6,771	2,649.2	Rhode Island	464	255.6
Indiana	4,964	1,822.0	South Carolina	3,255	2,013.6
Iowa	7,220	3,350.2	South Dakota	6,256	4,039.4
Kansas	7,933	3,643.0	Tennessee	3,866	1,682.4
Kentucky	3,699	1,911.0	Texas	12,797	7,802.7
Louisiana	2,725	1,566.8	Utah	1,743	1,203.5
Maine	1,576	720.4	Vermont	1,036	339.1
Maryland	1,958	778.9	Virginia	3,748	1,922.9
Massachusetts	1,486	817.3	Washington	3,177	1,197.9
Michigan	5,215	2,071.5	West Virginia	2,223	893.3
Minnesota	6,880	3,956.1	Wisconsin	5,493	2,593.8
Mississippi	3,562	1,809.0	Wyoming	3,525	1,894.3
Missouri	7,530	2,922.0	Hawaii	532	76.3
Montana	5,238	2,724.3			
Nebraska	5,574	4,255.2	Total	200,013	101,032.1
Nevada	1,560	1,281.2			

TABLE 17.—*Total cost, Federal aid and mileage of Federal-aid roads, initial and stage construction and reconstruction completed and paid during the fiscal year 1932*

State	Total cost	Federal aid	Mileage			
			Initial	Stage	Reconstruction	Total
Alabama	$6,632,377.81	$3,254,107.34	178.2	141.4		319.6
Arizona	4,592,313.37	2,997,498.86	163.4	260.6		424.0
Arkansas	10,013,059.31	4,456,690.96	228.9	99.4		328.3
California	11,201,066.65	4,485,886.08	311.9	84.9		396.8
Colorado	3,447,804.58	1,694,598.24	126.3	31.8		158.1
Connecticut	1,867,636.38	878,020.33	26.2			26.2
Delaware	1,134,643.28	560,157.40	39.2			39.2
Florida	3,610,613.72	1,636,690.21	86.0	5.5		91.5
Georgia	12,771,811.73	5,996,705.60	438.7	185.9		624.6
Idaho	3,522,448.95	1,926,478.79	252.6	12.3		264.9
Illinois	12,797,517.97	5,933,485.69	393.6	34.3		427.9
Indiana	6,012,180.66	2,836,159.83	234.6			234.6
Iowa	7,301,368.36	3,450,553.00	172.8	94.9		267.7
Kansas	8,645,189.65	4,090,582.58	534.9	80.0		614.9
Kentucky	6,542,441.54	2,841,986.71	204.9	174.8		379.7
Louisiana	6,197,247.26	2,845,033.17	198.7	9.6		208.3
Maine	3,907,936.98	1,630,960.17	109.9			109.9
Maryland	2,104,954.35	915,829.37	48.2	2.4	13.5	64.1
Massachusetts	2,127,908.58	718,153.25	32.3			32.3
Michigan	6,529,407.71	2,505,034.65	175.7	29.3	10.0	215.0
Minnesota	6,988,206.20	3,134,677.95	76.9	288.7		365.6
Mississippi	1,215,289.64	580,441.10	24.2	29.5		53.7
Missouri	10,963,758.56	4,692,498.85	322.3	117.1		439.4
Montana	8,814,187.67	4,954,604.16	734.4	195.3		929.7
Nebraska	11,050,135.87	4,919,538.59	395.9	286.5		682.4
Nevada	2,610,230.36	1,753,355.65	92.8	216.3	9.2	318.3
New Hampshire	1,258,769.77	500,610.26	30.1	5.7		35.8
New Jersey	2,424,799.76	843,003.18	42.1			42.1
New Mexico	4,868,755.39	2,926,337.86	152.5	154.4		306.9
New York	23,079,122.35	9,566,202.30	537.0			537.0
North Carolina	8,075,429.64	3,924,537.34	263.0	77.2		340.2
North Dakota	3,971,186.11	2,020,516.18	552.0	718.2		1,270.2
Ohio	15,202,321.86	5,316,423.89	325.2	26.6		351.8
Oklahoma	4,782,563.77	2,417,603.74	236.3	53.7	2.5	292.5

TABLE 17.—*Total cost, Federal aid and mileage of Federal-aid roads, initial and stage construction and reconstruction completed and paid during the fiscal year 1932*—Continued

State	Total cost	Federal aid	Mileage			
			Initial	Stage	Reconstruction	Total
Oregon	5,044,059.26	2,712,369.05	229.2	62.9		292.1
Pennsylvania	14,225,833.65	5,577,855.61	373.4			373.4
Rhode Island	2,434,647.26	1,088,088.58	48.2			48.2
South Carolina	7,206,238.21	3,108,948.33	90.1	214.7		304.8
South Dakota	4,634,538.92	2,538,254.19	342.4	182.8		525.2
Tennessee	5,966,504.20	2,816,329.72	238.5	39.0		277.5
Texas	18,660,872.18	8,576,426.20	712.4	382.8		1,095.2
Utah	3,561,558.52	2,097,325.15	198.0	180.0		378.0
Vermont	1,468,264.59	656,249.12	41.6	4.8		46.4
Virginia	5,860,425.66	2,626,607.86	263.9	37.9		301.8
Washington	6,264,501.27	2,640,753.51	172.6	43.7		216.3
West Virginia	3,573,588.79	1,370,430.44	91.1	21.2		112.3
Wisconsin	6,970,072.08	3,032,890.78	189.4	82.7		272.1
Wyoming	3,749,014.50	2,158,661.99	269.5	256.3		525.8
Hawaii	1,331,466.90	513,956.26	34.9			34.9
Total	317,216,271.78	144,720,610.07	11,036.9	4,925.1	35.2	15,997.2

TABLE 18.—*Total cost, Federal aid and mileage of Federal-aid roads, initial and stage construction and reconstruction completed but final payment not made, June 30, 1932*

State	Estimated total cost	Federal aid allotted	Mileage			
			Initial	Stage	Reconstruction	Total
Alabama	$578,077.61	$246,770.80	14.8	3.4		18.2
Arizona	1,578,764.61	1,103,669.67	95.0	28.3		123.3
Arkansas	1,928,887.35	913,774.12	44.1	26.0		70.1
California	3,013,966.78	1,409,192.32	82.4	1.0		83.4
Colorado	3,229,021.50	1,714,992.81	125.4	46.6		172.0
Connecticut	77,426.08	38,713.04	.2			.2
Delaware	13,896.00	6,948.00	.5			.5
Florida	1,606,558.69	692,419.44	43.7			43.7
Georgia	668,968.44	324,964.67	1.3	29.2		30.5
Idaho	330,035.93	162,473.62	3.7	12.1		15.8
Illinois	2,578,118.88	1,110,131.48	64.7	3.2		67.9
Indiana	2,823,800.18	1,383,456.85	97.9			97.9
Kansas	1,143,973,06	538,855.16	53.4	3.7		57.1
Kentucky	1,808,222.75	854,900.14	95.8			95.8
Louisiana	128,679.81	64,339.90	16.1			16.1
Maine	386,120.90	163,689.03	14.4			14.4
Maryland	779,309.75	389,654.86	24.1			24.1
Massachusetts	10,217,252.90	2,442,676.90	96.0			96.0
Michigan	4,628,263.68	1,949,452.18	131.6	7.5	6.1	145.2
Mississippi	444,619.95	217,882.68	5.8	8.5		14.3
Missouri	837,589.56	331,845.03	20.0			20.0
Montana	1,109,913.73	626,012.85	90.2			90.2
Nebraska	3,367,213.68	1,617,516.52	82.5	93.7		176.2
Nevada	669,728.89	480,857.05	12.9	32.7		45.6
New Hampshire	532,867.32	205,620.18	8.6			8.6
New Jersey	1,542,935.62	637,765.75	19.9	.3		20.2
New Mexico	2,304,393.35	1,479,028.57	121.6			121.6
New York	8,494,202.83	1,971,869.98	117.1	7.0		124.1
North Carolina	185,758.87	84,110.27	8.2			8.2
North Dakota	710,748.40	355,374.14	79.5	104.8		184.3
Ohio	4,499,564.74	1,650,524.44	40.8	19.6		60.4
Oklahoma	4,041,351.09	2,088,763.36	128.7	54.9	3.2	186.8
Oregon	1,088,710.14	603,258.36	39.7	15.9		55.6
Pennsylvania	4,404,756.10	1,844,826.32	17.9			17.9
South Carolina	635,046.04	290,317.76	21.5	6.3		27.8
South Dakota	727,708.13	352,387.95	13.5	25.5		39.0
Tennessee	251,140.36	123,435.52	9.5	4.3		13.8
Texas	5,347,469.11	2,420,142.95	250.7	80.2		330.9
Utah	182,856.02	110,885.58	12.9	.5		13.4
Virginia	1,769,338.18	784,928.90	75.0	20.4		95.4
Washington	375,039.77	198,800.00	11.7			11.7
West Virginia	1,845,277.70	817,877.27	47.3	.3		47.6
Wisconsin	438,441.22	171,335.38	16.7			16.7
Wyoming	182,681.38	99,989.27	12.2	16.2		28.4
Total	83,508,697.08	35,076,431.07	2,269.5	652.1	9.3	2,930.9

TABLE 19.—*Total cost, Federal aid and mileage of Federal-aid roads, initial and stage and reconstruction improvement, under construction, by States, June 30, 1932*

State	Estimated total cost	Federal aid allotted	Mileage			
			Initial	Stage	Reconstruction	Total
Alabama	$1,812,011.04	$884,109.47	74.1			74.1
Arizona	2,782,928.26	2,014,700.15	104.9	61.7		166.6
Arkansas	2,452,768.24	1,127,328.92	64.7	45.1		109.8
California	10,475,483.57	4,985,605.01	211.3	52.0		263.3
Colorado	4,355,182.99	2,276,199.42	171.4	50.8		222.2
Connecticut	4,362,762.05	1,613,060.26	30.2			30.2
Delaware	870,529.25	435,264.62	41.2			41.2
Florida	3,563,837.58	1,659,559.53	102.1			102.1
Georgia	6,410,060.34	2,999,196.48	160.3	166.8		327.1
Idaho	2,573,893.23	1,517,125.45	123.5	93.7		217.2
Illinois	25,384,659.55	11,764,654.34	751.9	36.8		788.7
Indiana	10,326,406.44	5,114,814.33	352.4	20.5		372.9
Iowa	3,512,604.68	1,639,295.18	178.3	40.4		218.7
Kansas	5,160,560.54	2,521,332.53	293.4	68.2		361.6
Kentucky	2,439,460.44	1,079,480.86	144.2	4.0		148.2
Louisiana	7,471,657.46	3,511,759.18	87.0	10.6		97.6
Maine	3,348,521.01	1,423,360.93	82.9			82.9
Maryland	701,917.80	255,754.94	23.4	.6		24.0
Massachusetts	7,129,265.67	2,897,641.92	71.3	.2		71.5
Michigan	9,062,647.19	4,162,775.75	395.4	31.9		427.3
Minnesota	11,284,587.17	3,749,501.38	204.9	296.8		501.7
Mississippi	3,910,633.74	1,915,689.81	171.2	68.8		240.0
Missouri	7,031,555.37	3,036,644.01	191.0	88.3		279.3
Montana	4,576,181.82	2,572,131.43	397.7	31.5		429.2
Nebraska	3,329,003.58	1,650,271.38	151.9	26.1		178.0
Nevada	1,576,562.30	1,289,906.62	21.2	163.0		184.2
New Hampshire	339,864.67	140,869.77	9.5	2.5		12.0
New Jersey	4,716,807.19	1,770,638.23	34.3	.5		34.8
New Mexico	1,469,046.56	1,028,823.23	61.9	17.8		79.7
New York	14,125,400.00	6,352,125.00	334.3			334.3
North Carolina	1,152,326.37	567,278.11	67.6	5.0		72.6
North Dakota	3,316,919.40	1,680,534.96	383.7	283.5		667.2
Ohio	6,314,566.20	2,097,263.73	101.7	26.4		128.1
Oklahoma	3,478,222.78	1,625,741.63	157.3	36.7	8.3	202.3
Oregon	4,145,699.29	2,305,513.64	128.0	47.1		175.1
Pennsylvania	5,021,298.77	2,322,443.57	181.7			181.7
Rhode Island	926,504,32	459,140.00	16.7		2.2	18.9
South Carolina	3,131,546.27	1,409,414.06	73.2	59.7		132.9
South Dakota	3,318,617.13	1,909,863.38	266.1	183.8		449.9
Tennessee	1,427,533.89	697,948.21	48.7	6.4		55.1
Texas	13,843,539.36	6,348,479.78	605.0	223.6		828.6
Utah	1,109,608.87	797,552.81	84.9	27.7		112.6
Vermont	1,408,800.97	630,501.86	45.6			45.6
Virginia	1,915,279.75	957,639.81	113.5	6.2		119.7
Washington	2,915,547.20	1,432,094.35	106.2	14.5		120.7
West Virginia	1,783,964.32	768,721.07	44.5	10.5		55.0
Wisconsin	7,833,923.20	3,203,398.32	204.8	75.4		280.2
Wyoming	3,630,824.26	2,232,041.40	192.4	230.9		423.3
Hawaii	811,202.36	395,047.85	22.0			22.0
Total	234,042,724.44	109,230,238.67	7,885.4	2,616.0	10.5	10,511.9

TABLE 20.—*Total cost, Federal aid and mileage of Federal-aid roads, initial and stage and reconstruction improvement, approved for construction, by States, June 30, 1932*

State	Estimated total cost	Federal aid allotted	Mileage			
			Initial	Stage	Reconstruction	Total
Arizona	$4,594.57	$3,459.24		0.3		0.3
Arkansas	404,816.95	201,796.90	17.4			17.4
California	1,475,029.90	645,642.39	44.4	7.0		51.4
Colorado	73,822.81	41,458.88	7.5			7.5
Connecticut	563,726.40	263,977.96	7.7			7.7
Delaware	86,524.00	43,262.00	4.7			4.7
Florida	655,532.89	327,766.42	17.3			17.3
Georgia	174,461.46	87,230.72	6.5	1.2		7.7
Idaho	1,302,449.66	781,761.33	30.8	228.7		259.5
Illinois	3,495,560.26	1,569,434.05	125.4	5.2		130.6
Indiana	1,609,394.59	792,712.22	73.7			73.7
Iowa	2,294,536.74	1,072,924.03	106.9	25.4		132.3
Kansas	2,324,281.14	1,126,345.63	72.3	304.6		376.9
Kentucky	1,399,504.67	525,166.87	17.3	107.8		125.1
Louisiana	1,103,383.51	538,516.32	29.8	13.3		43.1
Maine	887,397.91	431,757.49	34.3			34.3
Maryland	1,633,360.88	691,459.64	60.4	5.6		66.0
Michigan	655,889.46	325,630.00	21.4	20.1		41.5
Minnesota	842,326.55	229,800.00	15.7	20.2		35.9
Mississippi	116,017.23	58,008.61	16.1			16.1
Missouri	689,291.30	329,813.03	25.1	11.9		37.0
Montana	67,501.64	36,033.68	5.7	4.2		9.9
Nebraska	1,817,311.97	845,048.85	28.1	111.6		139.7
Nevada	859,152.00	693,501.34	26.8	19.6	13.7	60.1
New Jersey	1,023,047.07	496,650.88	.9			.9
New Mexico	998,601.99	618,039.80	41.1	42.3		83.4
New York	6,402,600.00	2,462,500.00	135.9			135.9
North Carolina	300,312.76	150,156.36	7.1	4.0		11.1
North Dakota	1,931,160.99	973,516.22	183.5	478.4		661.9
Ohio	6,292,605.00	2,240,240,53	153.0	46.4		199.4
Oklahoma	1,713,059.54	877,359.08	112.5	17.6		130.1
Oregon	1,590,510.22	864,268.36	46.9	74.8		121.7
Pennsylvania	6,392,381.18	2,851,912.07	196.7			196.7
South Carolina	101,152.78	50,000.00	5.2			5.2
South Dakota	233,615.05	157,987.24	30.8	12.0		42.8
Tennessee	733,446.20	356,461.69	17.1	21.8		38.9
Texas	3,980,124.61	1,802,196.04	232.1	185.1		417.2
Utah	847,650.66	635,771.92	37.6	108.5		146.1
Vermont	7,618.95	3,809.47				
Virginia	754,053.46	298,883.54	22.9	21.5		44.4
Washington	519,265.07	213,800.00	11.5	5.3		16.8
West Virginia	283,803.60	132,744.79	6.2			6.2
Wisconsin	1,110,874.93	432,400.00	29.6	23.5		53.1
Wyoming	205,019.30	134,595.13	26.2	20.1		46.3
Hawaii	740,008.72	598,548.44	18.8	3.6		22.4
Total	60,696,780.57	28,014,349.16	2,110.9	1,951.6	13.7	4,076.2

TABLE 21.—*Mileage of Federal-aid roads improved, by types of construction, by States, June 30, 1932*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							
Alabama	241.9	518.7		901.1	4.5		14.7		62.8	135.0	502.7		12.5	2,393.9
Arizona	27.5	40.7		410.7				580.5	.9	38.1	111.4		10.3	1,220.1
Arkansas	92.7			903.4		41.1	86.2			266.0	551.9		18.9	1,960.2
California	403.5			470.6		31.8		357.5	112.7	273.0	661.9		17.6	2,328.6
Colorado	185.7	47.5		707.4		91.3		138.0		14.3	396.4		22.6	1,603.2
Connecticut				.2		17.2	.1		42.7	.6	215.5		5.4	281.7
Delaware	.5			20.2				11.7		5.3	300.9	6.2	.9	345.7
Florida	4.4	15.5			1.0	85.4	109.5		72.5	78.7	251.0	10.2	9.8	638.0
Georgia	236.5	873.5		385.0	3.7	52.3	252.4	32.0	226.9	118.0	858.0	3.0	27.1	3,068.4
Idaho	198.0			738.2		203.7		151.6	20.3	93.1	49.8		5.6	1,460.3
Illinois	119.5			.4					3.3	8.1	2,479.7	31.6	6.6	2,649.2
Indiana	15.5			90.2					17.0	12.0	1,674.8	6.6	5.9	1,822.0
Iowa	1,048.3			488.8							1,789.0	22.0	2.1	3,350.2
Kansas	1,211.0	584.0		386.2	115.6	.2		68.7	129.9	2.9	959.6	164.4	20.5	3,643.0
Kentucky	583.7			476.2		20.5	50.3	25.7	84.3	202.5	457.3	3.9	6.6	1,911.0
Louisiana	78.5			1,282.8					3.2	41.8	146.0		14.5	1,566.8
Maine				235.0	127.5				191.0		164.6		2.3	720.4
Maryland	4.9			38.9		.1	3.9		237.7	37.1	455.6		.7	778.9
Massachusetts				.4	.4	.2	2.7	19.0	450.1	76.7	259.8		8.0	817.3
Michigan	75.3			355.5			16.3		5.4	86.6	1,526.9	.4	5.1	2,071.5
Minnesota	1,008.8	11.1		1,575.3	17.7					32.7	1,307.8		2.7	3,956.1
Mississippi	280.8	15.8		1,169.2		11.1				12.5	296.5	9.6	13.5	1,809.0
Missouri	398.7			699.3		19.6			27.4	20.0	1,735.1	7.5	14.4	2,922.0
Montana	310.5			2,013.2				339.2		13.0	37.4		11.0	2,724.3
Nebraska	351.1	3,393.8	6.6					28.4		14.6	429.3	19.4	12.0	4,255.2
Nevada	36.6			507.2	10.2			658.0	20.5	11.1	35.9		1.7	1,281.2
New Hampshire					.2	92.2	87.4		86.8	32.5	116.7		5.2	421.0
New Jersey	11.6			6.0			.2		.7	22.5	572.1		3.4	616.5
New Mexico	240.6	19.1		1,658.4				234.0		.7	87.1		10.2	2,250.1
New York	68.3			79.9					446.2	90.0	2,586.3	.7	2.0	3,273.4
North Carolina	81.1	457.3		116.3	20.9	25.8		125.6	35.6	288.1	1,068.1		7.6	2,226.4
North Dakota	998.3	.2		3,845.3	129.1			61.5		1.1	18.1		9.1	5,062.7
Ohio	123.6			41.1		107.9	26.1		373.9	148.3	1,377.3	643.0	17.2	2,858.4
Oklahoma	513.7	.6		532.7	8.3	28.8			.6	151.0	1,033.9	8.9	16.7	2,295.2
Oregon	346.4			752.2	28.1	45.1	27.8	11.5	133.2	61.0	109.5		8.0	1,522.8
Pennsylvania	168.4					311.2	10.6		7.8	99.2	2,366.6	43.3	5.5	3,012.6
Rhode Island							1.8		90.8	48.9	111.5		2.6	255.6
South Carolina	52.8	1,013.4		101.0					.3	185.0	637.1		24.0	2,013.6
South Dakota	104.3	20.2	15.7	3,711.5	7.6			51.2			122.4		6.5	4,039.4
Tennessee	222.1			106.2		61.5			353.4	190.0	739.3		9.9	1,682.4

Texas	1,008.7	26.2		2,677.0	357.6	83.4	187.2	19.8	528.8	810.8	2,025.9	30.2	47.1	7,802.7
Utah	108.0			320.0	7.4	348.4		285.9	.8	13.9	115.3		3.8	1,203.5
Vermont				108.1	2.0	1.1			58.1		163.0		6.8	339.1
Virginia	158.4	338.5	13.7	111.1	5.2	284.1	37.5		387.9	40.9	534.2		11.4	1,922.9
Washington	221.5			543.8							426.3		6.3	1,197.9
West Virginia	254.1			34.3		19.5	1.7	1.4	199.5	28.1	341.2	10.6	2.9	893.3
Wisconsin	166.4	19.6		938.9	15.8				13.8	.5	1,428.5		10.3	2,593.8
Wyoming	456.6	.1		1,006.7				381.0	1.7	22.1	17.4		8.7	1,894.3
Hawaii	3.6								39.7	13.3	19.0		.7	76.3
Total	12,222.4	7,395.8	36.0	30,545.9	862.8	1,983.5	916.4	3,582.2	4,468.2	3,841.6	33,671.6	1,021.5	484.2	101,032.1

TABLE 22.—*Mileage of Federal-aid roads, by types of construction, by States, initially completed and paid for during fiscal year 1932*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							
Alabama	37.8			1.0							138.1		1.3	178.2
Arizona	10.1			95.4				55.8					2.1	163.4
Arkansas	17.6			37.4							168.2		5.7	228.9
California	17.4			32.5		9.3		149.7	11.4	49.6	38.8		3.2	311.9
Colorado				99.1				19.1			5.1		3.0	126.3
Connecticut											25.1		1.1	26.2
Delaware											38.9		.3	39.2
Florida							37.0			14.4	33.8		.8	86.0
Georgia	75.2	13.7					112.0	27.1	8.7	29.7	170.6		1.7	438.7
Idaho	17.1			197.9				35.7					1.9	252.6
Illinois	4.5										385.9		3.2	393.6
Indiana	18.7										215.1		.8	234.6
Iowa											172.8			172.8
Kansas	212.4	86.3		25.0	76.5			42.1			88.9		3.7	534.9
Kentucky	61.7			61.7				1.5			79.0		1.0	204.9
Louisiana	19.3			100.4							72.4		6.6	198.7
Maine					60.8				6.1		41.4		1.6	109.9
Maryland	.1			7.4					2.2	3.0	35.5			48.2
Massachusetts									17.5	8.0	6.4		.4	32.3
Michigan	35.0			41.1							99.1		.5	175.7
Minnesota	35.2										41.7			76.9
Mississippi	16.1										7.4		.7	24.2
Missouri	62.7			66.5							190.7		2.4	322.3
Montana	74.3			553.7				102.9		.6	.5		2.4	734.4
Nebraska	.2	302.1	5.7					24.7			60.9		2.3	395.9
Nevada				74.5				18.3						92.8

TABLE 22.—*Mileage of Federal-aid roads, by types of construction, by States, initially completed and paid for during fiscal year 1932*—Con.

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							
New Hampshire							6.6		1.9	1.2	20.1		.3	30.1
New Jersey									.2		41.5		.4	42.1
New Mexico	11.4			93.2				46.0					1.9	152.5
New York	4.2			4.5					25.7	58.4	444.2			537.0
North Carolina	.5	8.6			20.9			66.5		23.6	140.3		2.6	263.0
North Dakota	414.7			131.7				.3			4.7		.6	552.0
Ohio	7.5			9.8		6.5			18.9	1.4	229.9	47.4	3.8	325.2
Oklahoma	155.0			7.4						4.2	68.2		1.5	236.3
Oregon	69.1			23.9	28.1	11.0	16.7	11.5	60.0		6.8		2.1	229.2
Pennsylvania	16.5					279.3				.8	73.0	2.1	1.7	373.4
Rhode Island									23.3	.8	23.4		.7	48.2
South Carolina		15.4									74.2		.5	90.1
South Dakota	7.5			332.8							.5		1.6	342.4
Tennessee	141.3									16.9	78.3		2.0	238.5
Texas	427.4			9.7	.4		14.5			19.5	232.2		8.7	712.4
Utah				114.8				72.1		3.3	7.0		.8	198.0
Vermont				5.8							35.3		.5	41.6
Virginia	29.0	55.3	13.7	15.6	5.2	83.4	26.0		2.1	1.2	30.5		1.9	263.9
Washington	36.8			82.2							52.9		.7	172.6
West Virginia	8.3			4.4			1.1	1.4	24.5		51.2		.2	91.1
Wisconsin	7.1			49.7							131.2		1.4	189.4
Wyoming	109.0			63.6				92.5	1.7		1.5		1.2	269.5
Hawaii	1.9								32.8				.2	34.9
Total	2,162.6	481.4	19.4	2,342.7	191.9	389.5	213.9	767.2	237.0	236.6	3,863.2	49.5	82.0	11,036.9

TABLE 23.—*Mileage of Federal-aid roads, by types of construction, by States, initial construction completed but final payment not made June 30, 1932*

State	Graded and drained	Sand-clay, untreated	Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland-cement concrete	Block	Bridges and approaches	Total
			Untreated	Treated	Untreated	Treated							
Alabama	14.2											0.6	14.8
Arizona			49.9				42.1			1.7		1.3	95.0
Arkansas	13.8									29.8		.5	44.1
California	4.6		20.7				37.2		12.0	6.7		1.2	82.4
Colorado	8.2		102.8				8.3			4.1		2.0	125.4
Connecticut												.2	.2
Delaware	.5												.5
Florida									3.7	39.1		.9	43.7
Georgia	.8									.4		.1	1.3
Idaho			2.5				1.2						3.7
Illinois	2.0									62.2		.5	64.7
Indiana										96.8		1.1	97.9
Kansas	17.6		21.5							14.0		.3	53.4
Kentucky	56.1		13.3							26.0		.4	95.8
Louisiana	16.1												16.1
Maine				11.3				3.1					14.4
Maryland								17.8		6.3			24.1
Massachusetts								43.0	4.5	45.7		2.8	96.0
Michigan	26.0		6.6						12.1	86.6		.3	131.6
Mississippi										5.5		.3	5.8
Missouri	4.2									15.5		.3	20.0
Montana	20.0		33.5				36.5					.2	90.2
Nebraska		76.7								4.8		1.0	82.5
Nevada			11.6				1.3						12.9
New Hampshire										8.1		.5	8.6
New Jersey										19.7		.2	19.9
New Mexico			77.8				39.6			3.0		1.2	121.6
New York	24.2		2.3					7.1	9.2	74.3			117.1
North Carolina									2.2	6.0			8.2
North Dakota	57.3		22.1									.1	79.5
Ohio	2.8		.4							25.6	7.7	4.3	40.8
Oklahoma	35.8									92.3		.6	128.7
Oregon			11.2		7.3	7.7		13.3				.2	39.7
Pennsylvania	.8				7.5					7.7	1.0	.9	17.9
South Carolina										21.5			21.5
South Dakota			13.1							.3		.1	13.5
Tennessee									4.3	5.2			9.5
Texas	150.1		8.2	11.0				.5		78.8		2.1	250.7

TABLE 23.—*Mileage of Federal-aid roads, by types of construction, by States, initial construction completed but final payment not made June 30, 1932*—Continued

State	Graded and drained	Sand-clay, untreated	Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland-cement concrete	Block	Bridges and approaches	Total
			Untreated	Treated	Untreated	Treated							
Utah	1.3		10.7							.6		.3	12.9
Virginia	4.1	38.5			24.7			7.3				.4	75.0
Washington			11.6									.1	11.7
West Virginia	15.1									31.8		.4	47.3
Wisconsin	6.4									10.3			16.7
Wyoming			10.7				1.4					.1	12.2
Total	482.0	115.2	430.5	22.3	39.5	7.7	167.6	92.1	48.0	830.4	8.7	25.5	2,269.5

TABLE 24.—*Mileage of Federal-aid roads by types of construction, by States, under initial construction, June 30, 1932*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							
Alabama	73.8												0.3	74.1
Arizona	3.5			59.3				41.4					.7	104.9
Arkansas	23.5			4.2							36.9		.1	64.7
California	52.0			.9				68.9		28.2	58.2		3.1	211.3
Colorado				82.0				80.6			6.1		2.7	171.4
Connecticut										.2	26.4		3.6	30.2
Delaware	4.9			10.2							25.5		.6	41.2
Florida	57.5						20.1			.4	20.0		4.1	102.1
Georgia	86.5	10.8			8.2		23.4	.9			29.7		.8	160.3
Idaho		1.4		103.2				18.4					.5	123.5
Illinois	81.7										661.9		8.3	751.9
Indiana	32.1										314.9		5.4	352.4
Iowa	4.9			81.5	11.4						79.9		.6	178.3
Kansas	193.6	8.0			31.5			41.0			16.8		2.5	293.4
Kentucky	92.7			13.1							37.8		.6	144.2
Louisiana	4.0			3.4							76.7		2.9	87.0
Maine					24.1				26.4		31.2		1.2	82.9

Maryland									3.7		19.7			23.4
Massachusetts									32.4	2.9	32.0		4.0	71.3
Michigan	187.6			40.9							165.2		1.7	395.4
Minnesota	96.6										108.3			204.9
Mississippi	142.0										26.9		2.3	171.2
Missouri	8.0			41.4							140.7		.9	191.0
Montana	149.4			179.9				67.1					1.3	397.7
Nebraska	.2	76.3						49.2			24.8		1.4	151.9
Nevada				11.0				10.2						21.2
New Hampshire							4.7				4.8			9.5
New Jersey											32.6		1.7	34.3
New Mexico				27.0				31.2			2.4		1.3	61.9
New York	36.6			10.8					21.0	33.4	232.4		.1	334.3
North Carolina	12.0		26.8		18.5			10.1					.2	67.6
North Dakota	302.4			79.8				1.1					.4	383.7
Ohio				7.7					8.0	.1	54.5	24.8	6.6	101.7
Oklahoma	77.4										79.5		.4	157.3
Oregon	39.9			14.4	9.8		38.6		24.3				1.0	128.0
Pennsylvania	.1					103.9					77.4		.3	181.7
Rhode Island	5.8								3.7		6.7		.5	16.7
South Carolina											73.1		.1	73.2
South Dakota	162.0			103.5				.3					.3	266.1
Tennessee	12.5									17.9	17.4		.9	48.7
Texas	410.3			8.1	73.6		32.3		6.0		66.7		8.0	605.0
Utah				60.0				24.5					.4	84.9
Vermont				.5	4.3			11.9	3.1		25.4		.4	45.6
Virginia	32.2	47.4				30.9					2.9		.1	113.5
Washington	33.1			54.2							18.3		.6	106.2
West Virginia	26.9										17.6			44.5
Wisconsin	24.2			19.2							159.8		1.6	204.8
Wyoming	32.1			77.3			6.9	75.0					1.1	192.4
Hawaii									21.4				.6	22.0
Total	2,502.0	143.9	26.8	1,093.5	181.4	134.8	126.0	531.8	150.0	83.1	2,811.1	24.8	76.2	7,885.4

TABLE 25.—*Mileage of Federal-aid roads, by types of construction, by States, approved for initial construction, on June 30, 1932*

State	Graded and drained	Sand-clay, untreated	Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland-cement concrete	Block	Bridges and approaches	Total
			Untreated	Treated	Untreated	Treated							
Arkansas	7.8									9.2		0.4	17.4
California	11.8						25.1			7.3		.2	44.4
Colorado			7.5										7.5
Connecticut										7.5		.2	7.7
Delaware										4.7			4.7
Florida						14.0				2.4		.9	17.3
Georgia										6.5			6.5
Idaho			14.6				16.2						30.8
Illinois	27.7									96.9		.8	125.4
Indiana	7.2									66.5			73.7
Iowa	30.5		8.1							68.2		.1	106.9
Kansas	59.5									12.1		.7	72.3
Kentucky	13.0		3.5							.2		.6	17.3
Louisiana										29.7		.1	29.8
Maine			3.2	21.5				9.6					34.3
Maryland								25.6	13.0	21.6		.2	60.4
Michigan	9.8								11.1	.5			21.4
Minnesota										15.7			15.7
Mississippi	16.0											.1	16.1
Missouri	.8									24.3			25.1
Montana			5.7										5.7
Nebraska		6.6					14.3			7.1		.1	28.1
Nevada			3.3				23.5						26.8
New Jersey								.1		.6		.2	.9
New Mexico			40.8									.3	41.1
New York			53.0					20.6	13.9	48.0		.4	135.9
North Carolina	3.3	.2					3.0					.6	7.1
North Dakota	168.8		14.6									.1	183.5
Ohio	4.2		5.4					2.8	31.6	82.0	26.3	.7	153.0
Oklahoma	90.6									21.1		.8	112.5
Oregon			10.1				4.8	30.4	.9			.7	46.9
Pennsylvania					129.1					66.1		1.5	196.7
South Carolina										5.2			5.2
South Dakota	24.6		5.1							1.1			30.8
Tennessee	7.9								4.1	5.0		.1	17.1
Texas	194.8			28.0					.9	6.1		2.3	232.1
Utah			37.5									.1	37.6
Virginia					22.8							.1	22.9
Washington			4.3							7.2			11.5
West Virginia	1.9									4.1		.2	6.2
Wisconsin	12.4		9.6							6.9		.7	29.6
Wyoming	16.5		9.7										26.2
Hawaii								18.7				.1	18.8
Total	709.1	6.8	236.0	49.5	151.9	14.0	86.9	107.8	75.5	633.8	26.3	13.3	2,110.9

TABLE 26.—*Mileage of Federal-aid road stage construction, by types of construction, by States, completed and paid for during the fiscal year 1932*

State	Graded and drained	Sand-clay, untreated	Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland-cement concrete	Block	Bridges and approaches	Total
			Untreated	Treated	Untreated	Treated							
Alabama	2.9		0.5						30.6	107.0		0.4	141.4
Arizona			2.9				255.7	0.3		.5		1.2	260.6
Arkansas										99.2		.2	99.4
California	7.0		1.9				37.0		18.7	19.6		.7	84.9
Colorado			3.4				16.7			11.2		.5	31.8
Florida						5.4						.1	5.5
Georgia						46.2	5.0		16.5	115.2	2.5	.5	185.9
Idaho	1.3		6.4				4.6						12.3
Illinois										34.3			34.3
Iowa										94.9			94.9
Kansas		6.5	1.7	15.7			19.9			35.6		.6	80.0
Kentucky			26.5				19.9		35.0	93.3		.1	174.8
Louisiana										9.5		.1	9.6
Maryland								.1		2.3			2.4
Michigan									11.7	16.2		1.4	29.3
Minnesota	82.0									206.5		.2	288.7
Mississippi	.5									28.9		.1	29.5
Missouri	10.4									106.3		.4	117.1
Montana			46.7				148.4					.2	195.3
Nebraska	.3	121.7								163.5		1.0	286.5
Nevada			10.6				205.1					.6	216.3
New Hampshire										5.7			5.7
New Mexico			58.6				91.9			1.7		2.2	154.4
North Carolina	2.9		4.5				23.6		18.6	27.6			77.2
North Dakota	8.7		647.3				55.3			6.9			718.2
Ohio										25.4	.1	1.1	26.6
Oklahoma	10.8		5.7							36.9		.3	53.7
Oregon	11.9		9.5		1.2			38.5		1.8			62.9
South Carolina									5.6	208.5		.6	214.7
South Dakota	13.8		56.6	7.6			41.7			62.8		.3	182.8
Tennessee	5.5								3.9	29.5		.1	39.0
Texas	50.0			36.7	10.6	32.1			64.1	188.1		1.2	382.8
Utah	15.9		49.2				113.7			1.1		.1	180.0
Vermont								4.8					4.8
Virginia	.6		.5		3.7	5.7		4.0		23.0		.4	37.9
Washington			10.7							33.0			43.7
West Virginia	1.6							1.8		17.8			21.2
Wisconsin	1.5		1.2							79.6		.4	82.7
Wyoming	1.0		67.2				188.0					.1	256.3
Total	228.6	128.2	1,011.6	60.0	15.5	89.4	1,226.5	49.5	204.7	1,893.4	2.6	15.1	4,925.1

TABLE 27.—*Mileage of Federal-aid roads, by types of construction, by States, stage construction, completed but final payment not made, June 30, 1932*

State	Graded and drained	Sand-clay, untreated	Gravel, untreated	Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland-cement concrete	Block	Bridges and approaches	Total
				Untreated	Treated							
Alabama									3.4			3.4
Arizona			3.9			23.8		0.3			0.3	28.3
Arkansas									25.9		.1	26.0
California			.4								.6	1.0
Colorado						14.6			31.8		.2	46.6
Georgia									29.2			29.2
Idaho						8.7		3.4				12.1
Illinois									3.2			3.2
Kansas	1.0								2.6		.1	3.7
Michigan								7.2	.3			7.5
Mississippi									8.4		.1	8.5
Nebraska		14.8							78.4		.5	93.7
Nevada						32.3					.4	32.7
New Jersey											.3	.3
New York								7.0				7.0
North Dakota			104.8									104.8
Ohio			.2						8.8	9.5	1.1	19.6
Oklahoma	.5								54.3		.1	54.9
Oregon	1.9		.7		3.4		3.3	6.1	.4		.1	15.9
South Carolina									6.3			6.3
South Dakota	2.7		5.1						17.7			25.5
Tennessee									4.3			4.3
Texas	5.7				20.9			9.2	44.0		.4	80.2
Utah									.5			.5
Virginia		15.2		5.2								20.4
West Virginia									.3			.3
Wyoming			4.7			11.5						16.2
Total	11.8	30.0	119.8	5.2	24.3	90.9	3.3	33.2	319.8	9.5	4.3	652.1

TABLE 28.—*Mileage of Federal-aid roads, by types of construction, by States, under stage construction on June 30, 1932*

State	Graded and drained	Sand-clay, untreated	Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland-cement concrete	Bridges and approaches	Total
			Untreated	Treated	Untreated	Treated						
Arizona							61.4				0.3	61.7
Arkansas	18.6									26.3	.2	45.1
California							14.3		4.0	32.3	1.4	52.0
Colorado			3.7				42.3			4.3	.5	50.8
Georgia				3.4		61.7				101.3	.4	166.8
Idaho	3.2	5.4	14.1				70.9				.1	93.7
Illinois										36.7	.1	36.8
Indiana										20.1	.4	20.5
Iowa			8.5							31.9		40.4
Kansas	1.5			.6			51.8			13.8	.5	68.2
Kentucky	4.0											4.0
Louisiana	2.0									8.3	.3	10.6
Maryland										.6		.6
Massachusetts											.2	.2
Michigan	23.2								3.4	5.2	.1	31.9
Minnesota	36.5									260.2	.1	296.8
Mississippi	41.8									26.8	.2	68.8
Missouri			3.4							84.7	.2	88.3
Montana			.5				31.0					31.5
Nebraska		.1								25.5	.5	26.1
Nevada			.8				162.1				.1	163.0
New Hampshire										2.5		2.5
New Jersey											.5	.5
New Mexico			9.5				8.2				.1	17.8
North Carolina							5.0					5.0
North Dakota			166.9				116.5		.1			283.5
Ohio								1.3		24.9	.2	26.4
Oklahoma	6.9									29.7	.1	36.7
Oregon			13.6					33.2			.3	47.1
South Carolina										59.6	.1	59.7
South Dakota	42.2		28.0	25.3			79.1		4.9	4.0	.3	183.8
Tennessee									6.4			6.4
Texas	5.3			77.3		23.5			11.9	104.7	.9	223.6
Utah			6.4				21.1				.2	27.7
Virginia	3.9				2.2						.1	6.2
Washington			1.3							13.2		14.5
West Virginia	5.8									4.7		10.5
Wisconsin	.6		2.5							72.2	.1	75.4
Wyoming	28.8		76.0				125.8				.3	230.9
Total	224.3	5.5	335.2	106.6	2.2	85.2	789.5	34.5	30.7	993.5	8.8	2,616.0

TABLE 29.—*Mileage of Federal-aid roads, by types of construction, by States, approved for stage construction, June 30, 1932*

State	Graded and drained	Sand-clay, treated	Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
			Untreated	Treated	Untreated	Treated							
Arizona							0.1					0.2	0.3
California							4.4			2.6			7.0
Georgia						1.2							1.2
Idaho							228.6					.1	228.7
Illinois										5.1		.1	5.2
Iowa										25.4			25.4
Kansas	3.2						281.8		12.0	7.2		.4	304.6
Kentucky			38.5				12.4			56.8		.1	107.8
Louisiana										13.3			13.3
Maryland									4.6	1.0			5.6
Michigan									7.5	12.6			20.1
Minnesota	4.3									15.9			20.2
Missouri										11.9			11.9
Montana							4.2						4.2
Nebraska							70.9			40.5	0.1	.1	111.6
Nevada							19.4					.2	19.6
New Mexico			.4				41.6					.3	42.3
North Carolina		4.0											4.0
North Dakota			430.9				47.5						478.4
Ohio									22.2	18.7	5.4	.1	46.4
Oklahoma	5.2									12.4			17.6
Oregon			15.0			5.6		44.9	6.1	3.2			74.8
South Dakota	5.3		6.7										12.0
Tennessee									5.2	16.5		.1	21.8
Texas	53.6			49.2		10.7				71.1		.5	185.1
Utah							108.5						108.5
Virginia	.7				8.9			4.0	7.5			.4	21.5
Washington										5.3			5.3
Wisconsin	5.1		.3							17.3		.8	23.5
Wyoming			5.8				14.3						20.1
Hawaii								3.6					3.6
Total	77.4	4.0	497.6	49.2	8.9	17.5	833.7	52.5	65.1	336.8	5.5	3.4	1,951.6

TABLE 30.—*Net changes of mileage in the types of Federal-aid improvement on the Federal-aid highway system during the fiscal year 1932*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							
Alabama	52.2	−0.7		0.2	0.1		−0.3			19.7	204.5		2.4	278.1
Arizona	.4	2.4		70.1				299.7	0.4	.3	.5		4.4	378.2
Arkansas	25.5			−45.7			−.3				239.7		3.3	222.5
California	5.6			52.8		2.0		224.1	11.5	80.0	19.3		5.3	400.6
Colorado	8.2	−8.4		161.5		−4.3		46.5			52.0		4.4	259.9
Connecticut											24.8			24.8
Delaware	.5										38.9		.3	39.7
Florida							37.0			14.4	45.5		1.1	98.0
Georgia	2.8	−127.4		−23.0			122.7	32.0	−.6	29.8	235.3	2.5	−.7	273.4
Idaho	.2			134.2		−11.4		50.2		3.4			1.8	178.4
Illinois	2.5										375.4		3.6	381.5
Indiana	−1.4										242.8		1.6	243.0
Iowa	−56.6			−7.9							261.6			197.1
Kansas	144.3	34.2		35.7	85.3	−4.3		61.9			134.2	−1.2	4.1	494.2
Kentucky	96.2			84.0				11.0		35.0	164.2		1.6	392.0
Louisiana	35.3			35.6						−1.1	77.5		.6	147.9
Maine				−5.6	71.5				9.3		41.4		.6	117.2
Maryland				7.4					18.1	5.6	40.7		.1	71.9
Massachusetts									41.3	10.2	38.8		2.8	93.1
Michigan	52.9			12.5						27.6	172.0		1.7	266.7
Minnesota	−8.4			−271.0							248.0		.2	−31.2
Mississippi	−3.2	.1		−9.2							47.3		1.3	36.3
Missouri	33.6			−8.1					−5.6		251.4	−11.8	3.0	262.5
Montana	84.8			534.3				267.1		.5	.4		2.1	889.2
Nebraska	−45.2	230.0	−16.7					24.4			211.9	−.2	2.1	406.3
Nevada	−23.7			−7.9	−.6			212.5		9.1			−.2	189.2
New Hampshire						−4.3	4.9		.7	−1.8	27.9		.7	28.1
New Jersey	−.3								.2		60.7		.7	61.3
New Mexico	10.2			165.8				137.9			4.8		3.5	322.2
New York	21.7			4.0					36.2	74.5	453.0			589.4
North Carolina	−14.4	−13.2		−4.1	20.9			90.2		37.3	136.6		2.5	255.8
North Dakota	−97.4			729.0				55.6			11.5		.8	699.5
Ohio	4.7			6.9		1.3			5.6	−10.7	252.4	35.7	8.9	304.8
Oklahoma	133.1			6.8							172.5		1.5	313.9
Oregon	42.1			35.2	15.0	19.5	27.8	11.6	87.0	6.1	9.0		1.8	255.1
Pennsylvania	1.5					286.8				.8	54.0	3.0	2.1	348.2
Rhode Island									21.1	.8	17.8		.5	40.2
South Carolina		−23.7									182.7		1.1	160.1
South Dakota	−13.1	−.6		179.0	7.6			41.7			81.3		1.9	297.8
Tennessee	105.1								−2.8	25.1	91.8		1.8	221.0
Texas	283.2	−3.1		−108.4	47.7	10.7	67.5		−6.0	44.7	475.6		11.3	823.2

TABLE 30.—*Net changes of mileage in the types of Federal-aid improvement on the Federal-aid highway system during the fiscal year 1932*—Con.

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							
Utah	17.2			68.5	4.0	−114.9		174.4		3.3	8.7		.8	162.0
Vermont				5.8					4.6		26.6		.5	37.5
Virginia	17.5	85.1	13.7	15.6	5.2	81.1	31.8		4.8	.3	41.0		2.1	298.2
Washington	28.0			87.1							80.7		.7	196.5
West Virginia	11.0			3.6			1.1	1.4	18.1		84.8		.7	120.7
Wisconsin	4.1	−3.9		−38.5	−4.1						220.1		1.3	179.0
Wyoming	11.9	−10.1		−6.3				266.2	1.7		.2		1.7	265.3
Hawaii	1.9								26.7				.1	28.7
Total	974.5	160.7	−3.0	1,899.9	252.6	262.2	292.2	2,008.4	272.3	414.9	5,661.8	28.0	94.5	12,319.0

TABLE 31.—*Federal-aid apportionment, and amounts paid to the States for fiscal year 1932, and unobligated balance of the total apportionment June 30, 1932*

State	Apportionment fiscal year 1932	Paid to States during the fiscal year 1932	Unobligated balances of total apportionment on June 30, 1932
Alabama	$2,615,434	$1,449,558.66	$5,469,694.24
Arizona	1,768,023	2,445,249.48	742,533.48
Arkansas	2,174,786	2,443,071.02	2,162,507.23
California	4,181,212	5,013,452.92	32,946.23
Colorado	2,315,948	2,814,478.24	2,057,603.69
Connecticut	792,359	1,126,049.01	390,452.51
Delaware	609,375	512,060.63	167,140.82
Florida	1,543,232	1,245,206.16	2,541,174.33
Georgia	3,316,029	3,838,366.77	1,345,949.03
Idaho	1,554,594	1,682,385.02	345,018.54
Illinois	5,150,396	5,788,526.83	1,310,641.51
Indiana	3,172,253	4,134,264.18	381,104.02
Iowa	3,330,593	2,546,601.73	87,585.99
Kansas	3,397,874	3,291,566.93	567,001.31
Kentucky	2,356,367	1,949,897.63	1,182,786.01
Louisiana	1,745,445	2,049,281.07	321,408.48
Maine	1,121,860	1,664,568.68	137,272.92
Maryland	1,051,714	895,565.36	8,964.30
Massachusetts	1,813,916	2,492,975.93	602,611.77
Michigan	3,652,393	4,423,552.30	2,452,326.98
Minnesota	3,497,306	3,008,442.80	
Mississippi	3,209,509	1,372,689.21	5,152,976.98
Missouri	3,957,287	2,943,232.61	567,602.87
Montana	2,580,405	3,429,106.02	3,465,267.40
Nebraska	2,644,726	3,772,318.33	1,849,946.51
Nevada	1,598,987	1,708,195.22	86,974.21
New Hampshire	609,375	490,588.14	553,268.42
New Jersey	1,565,749	889,185.74	698,945.91
New Mexico	1,984,363	1,878,853.65	897,851.56
New York	6,002,475	11,167,966.22	2,250,042.54
North Carolina	2,871,722	2,366,819.85	3,728,867.35
North Dakota	2,001,841	1,931,074.18	821,723.31
Ohio	4,584,440	4,238,550.62	1,682,314.29
Oklahoma	2,922,569	2,086,708.87	1,276,063.13
Oregon	1,997,569	1,828,565.82	875,392.92
Pennsylvania	5,517,738	5,179,419.90	775,956.02
Rhode Island	609,375	976,232.74	325,565.85
South Carolina	1,769,848	1,409,926.16	744,636.09
South Dakota	2,054,077	2,486,985.52	1,085,351.79
Tennessee	2,687,123	1,494,839.91	3,157,110.04
Texas	7,620,239	8,447,826.24	3,333,824.82
Utah	1,416,493	1,276,689.88	520,628.78
Vermont	609,375	539,752.15	
Virginia	2,379,788	1,841,802.21	1,817,277.70
Washington	1,940,922	2,100,875.62	1,007,069.51
West Virginia	1,324,680	1,758,953.68	998,160.51
Wisconsin	3,075,234	2,739,618.37	283,938.52
Wyoming	1,568,607	1,804,001.52	120,711.31
Hawaii	609,375	391,220.01	1,335,908.87
Total	121,875,000	127,367,119.74	61,720,100.60

NATIONAL-FOREST-ROAD CONSTRUCTION

The appropriation authorized for forest-road and trail construction in the fiscal year 1932 was $12,500,000, of which $3,000,000 was for forest-development roads and $9,500,000 for forest highways.

In accordance with the rules and regulations promulgated by the Secretary of Agriculture, the Bureau of Public Roads supervises the work on major forest-road projects, which, by definition, include all projects in the forest-highway system except those which do not require the technical services of a highway-engineering organization, and those whose estimated average cost is less than $2,000 per mile. The term also includes forest-development road projects whose average cost exceeds $5,000 per mile or which require the technical services of a highway-engineering organization.

Forest highways, the more important from the traffic viewpoint of the two main classes of roads, have for several years been classified according to importance as of three classes defined by the rules and regulations. The class definitions included in the original rules and regulations have lately been found in need of amendment to bring them into better harmony with the development of the

State and Federal-aid systems and new definitions promulgated by the Secretary on June 30, 1931, establish three classes as follows:

(1) Any forest road in the Federal-aid highway system, either wholly within or, when so designated by the Forester and Chief of the Bureau of Public Roads, partly without and adjacent to the national forests.

(2) Any forest road, not of class 1, on an approved State highway system, when so designated by the Forester and the Chief of Bureau.

(3) All other forest roads, of primary importance to counties or communities.

The roads which, according to these definitions, have been classified as forest highways have an aggregate length of 16,274.68 miles, classified as shown in Table 32.

TABLE 32.—*Classification of the mileage of the forest-highway system as revised*

State	Mileage of forest-highway system			
	Class 1	Class 2	Class 3	Total
Western:				
Alaska			459.94	459.94
Arizona	320.6	192.7	525.10	1,038.4
California	563.7	814.1	969.9	2,347.7
Colorado	473.0	1,150.0	104.0	1,727.0
Idaho	584.21	215.0	244.7	1,043.91
Montana	628.3	335.8	238.0	1,202.1
Nevada	107.0	190.6	167.1	464.7
New Mexico	164.0	511.0	6.0	681.0
Oregon	527.13	340.38	506.43	1,373.94
South Dakota	219.0		86.0	305.0
Utah	57.65	539.30	139.2	736.15
Washington	386.5	124.3	259.0	769.8
Wyoming	387.3	37.0	217.7	642.0
Total	4,418.39	4,450.18	3,923.07	12,791.64
Eastern:				
Alabama	4.0	0	31.0	35.0
Arkansas	192.33	144.32	90.5	427.15
Florida	0.70	103.5	25.0	129.2
Georgia	41.8	0	106.2	148.0
Louisiana	36.3	105.7	12.0	154.0
Maine	0	0	11.0	11.0
Michigan	49.91	108.5	150.3	308.71
Minnesota	89.50		205.8	295.30
Nebraska			28.8	28.8
New Hampshire	41.5	60.5	49.0	151.0
North Carolina	78.0	129.3	48.3	255.6
Oklahoma	31.48		70.5	101.98
Pennsylvania	134.0	248.0	19.0	401.0
Puerto Rico			9.0	9.0
South Carolina		26.0	11.0	37.0
Tennessee	75.8	105.0	88.0	268.8
Vermont	7.0		12.0	19.0
Virginia	65.0	103.0	210.0	378.0
West Virginia	41.0	137.0	62.0	240.0
Wisconsin	5.0	48.5	31.0	84.5
Total	893.32	1,319.32	1,270.40	3,483.04
Grand total	5,311.71	5,769.50	5,193.47	16,274.68

During the past year improvements have been completed on 602.9 miles of the forest-highway system, bringing the total mileage improved to date with Federal funds to 5,242.2 miles. Of the mileage improved during the year, 571.2 miles were in the Western States and Alaska, and the remaining 31.7 miles were in the forests of six Eastern States. Of the total mileage improved to date, 4,852.8 miles are in the West and 389.4 in the East.

The mileage of forest-highway projects completed during the year and to date by States is shown in Table 33.

TABLE 33.—*Mileage of completed forest-highway projects, by States*

State	Mileage of forest-highway projects completed		State	Mileage of forest-highway projects completed	
	During 1932	Total to June 30, 1932		During 1932	Total to June 30, 1932
Western:			Eastern:		
Alaska	12.0	242.9	Alabama		5.1
Arizona	95.9	454.6	Arkansas		74.9
California	102.0	539.4	Florida	9.2	77.1
Colorado	50.4	416.2	Georgia		21.4
Idaho	47.8	590.7	Michigan	7.2	16.2
Montana	47.1	456.6	Minnesota		68.9
Nevada	15.9	142.7	New Hampshire	2.9	8.1
New Mexico	35.0	233.8	North Carolina	7.0	43.3
Oregon	102.3	808.1	South Carolina		15.6
South Dakota	1.6	47.8	Tennessee		37.4
Utah	13.8	354.3	Virginia		16.0
Washington	6.2	240.1	Pennsylvania	1.8	1.8
Wyoming	41.2	325.6	West Virginia	3.6	3.6
Total	571.2	4,852.8	Total	31.7	389.4
			Grand total	602.9	5,242.2

On June 30, 1932, work was in progress under the supervision of the Bureau of Public Roads on 608.7 miles of road at a total estimated cost of $6,180,196. Work estimated to cost $1,624,332 had been programmed but not yet started; and there was a balance of authorized funds not yet obligated to definite projects amounting to $894,393.

Standards of forest-highway work have been materially improved in the past two or three years. This has been necessitated by increases in traffic resulting from the improvement of adjoining State and Federal-aid roads. The new work is marked especially by superelevated curves of larger radii and by wider grades, and roads built earlier when a lower standard was permissible have been widened and reconstructed according to the modern standards. The use of light asphaltic residual oils and cutback asphalts has been found necessary to eliminate dust and reduce wear of the fine crushed-rock and gravel surfaces which have been laid on many of the roads built.

ROAD CONSTRUCTION IN THE NATIONAL PARKS

Road construction in the national parks, by agreement with the National Park Service is supervised by the Bureau of Public Roads, and 142 miles of such construction were completed during the past year, making the total thus far improved 512 miles, all of which is in the system of major park roads.

The mileage completed during the fiscal year and to date in the several parks is shown in Table 34.

TABLE 34.—*Mileage of national-park roads improved under the supervision of the Bureau of Public Roads*

National park	Mileage completed under supervision of the bureau		National park	Mileage completed under supervision of the bureau	
	During fiscal year 1932	Total to June 30, 1932		During fiscal year 1932	Total to June 30, 1932
Acadia	0.3	3.6	Mount Ralnier	1.2	50.3
Colonial National Monument	10.0	10.0	Petrified Forest, N. Mex	16.3	16.3
Crater Lake		23.3	Rocky Mountain		8.7
Devils Tower		.3	Sequoia	3.6	28.7
General Grant		4.0	Wind Cave		5.3
Glacier	4.4	36.9	Yellowstone	54.9	89.5
Grand Canyon	18.6	93.8	Yosemite	7.2	54.6
Hawaii		11.2	Zion	5.8	14.9
Lassen Volcanic	9.1	44.6			
Mesa Verde	12.2	18.2	Total	143.6	514.2

The Wawona Tunnel project in Yosemite National Park is rapidly nearing completion. This project which includes a tunnel approximately 4,200 feet in length, is being constructed at a cost of approximately $750,000. Several incidental contracts involving adit enlargement and tunnel ventilation have been awarded.

Of outstanding interest among the projects completed during the past year is the Babb-Many Glacier Highway in Glacier National Park. Two sections of this project were recently completed, covering a total distance of 4.4 miles. The Halstead Meadow section of the General's Highway in Sequoia National Park was also completed. In Lassen Volcanic National Park one section of the Loop route, a total distance of 7.7 miles, was also completed. This, together with the North Approach Road connection, which was also completed, virtually completes the Lassen Volcanic Park highway system. In Petrified Forest National Monument the Main North and South Highway, a distance of 16 miles, was graded during the past year. A contract is at present operative for the construction of two large bridges in this monument.

In Yellowstone National Park the East Entrance Highway, the Obsidian Cliff-Firehole Cascade section, and the Canyon Junction-Tower Junction section of the Grand Loop Highway are some of the more important projects completed.

Several bridge contracts were also completed during the past year. In Mount Rainier National Park the Frying Pan Creek bridge on the White River Road was completed at a cost of approximately $60,000.

In Sequoia National Park the Clover Creek, Lodge Pole, and Silliman Creek bridges were all completed under one contract. The cost of these bridges was approximately $90,000. In Yosemite National Park the Merced River bridge was completed at a cost of $35,000.

In the eastern parks two projects were completed during the past year. These projects were in Colonial National Monument, Va. One included a 9-mile stretch of graded earth road, another a mile of hydraulic fill. Two large projects which were let to contract in the proposed Shenandoah National Park, Va., are rapidly nearing completion. These contracts involve the grading of approximately 45 miles of pioneer road of the heavy mountain type. The estimated cost of this work is approximately $700,000. All work on these contracts is expected to be completed during September, 1932.

RESTORATION OF FLOOD-DAMAGED ROADS

No further appropriations for the relief of States on account of damage of roads by flood have been made since the date of the last annual report.

The amounts of the several appropriations made to date (less 2½ per cent allowed for Federal administration in the case of Alabama, Georgia, and South Carolina), the amounts paid the States up to June 30, 1932, and the unobligated balance for each State are shown in Table 35. The entire amounts appropriated for relief of Vermont and New Hampshire have been paid to the States, and all work has been completed. Only small parts of the appropriations made in aid of Georgia and South Carolina remained unexpended on June 30, and no part of the appropriation to either State was unobligated at the end of the year. Work under the appropriations is virtually completed in these States. The amounts paid during the year are reported in Table 36.

TABLE 35.—*Flood relief appropriated, amounts paid to States, and the unobligated balance of the appropriation June 30, 1932*

State	Appropriated	Paid to the States to June 30, 1932	Unobligated balance
Vermont	$2,654,000	$2,654,000.00	
New Hampshire	653,300	653,300.00	
Kentucky	1,889,994	667,751.49	$1,040,719.67
Total	5,197,294	3,975,051.49	1,040,719.67
Arkansas	1,800,000	1,477,693.56	322,306.44
Louisiana	967,582	786,271.13	181,310.87
Mississippi	628,000	345,266.57	282,733.43
Missouri	258,418		130,865.95
Total	3,654,000	2,609,231.26	917,216.69
Alabama	[1] 1,618,500	481,083.81	1,137,416.19
Georgia	[1] 493,416	418,208.01	
South Carolina	[1] 785,422	734,022.23	
Florida	80,307	76,052.83	1,380.99
Total	2,977,645	1,709,366.88	1,138,797.18
Grand total	11,828,939	8,293,649.63	3,096,733.54

[1] Does not include fund allowable for administration.

TABLE 36.—*Flood relief paid to the States, fiscal year 1932*

State	Amount	State	Amount
New Hampshire	$29,157.56	Alabama	$50,801.48
Kentucky	111,412.99	Georgia	418,208.01
		South Carolina	734,022.23
Total	140,570.55	Florida	76,052.83
Arkansas	425,515.27	Total	1,279,084.55
Louisiana	252,602.93	Grand total	2,097,773.30
Total	678,118.20		

The mileage of road improved under the relief acts up to the end of the fiscal year and the corresponding total cost and Federal payment are given in Table 37. Similar information for roads completed during the past year is presented in Table 38, and for roads under construction at the end of the year and approved for construction in Tables 39 and 40, respectively.

TABLE 37.—*Total cost, flood relief, and mileage of roads improved to June 30, 1932*

State	Total cost	Flood relief	Miles
Vermont	$5,651,965.83	$2,654,000.00	61.2
New Hampshire	1,408,479.45	653,300.00	29.1
Kentucky	1,412,004.52	588,215.41	67.4
Total	8,472,449.80	3,895,515.41	157.7
Arkansas	843,914.04	405,711.21	49.8
Mississippi	11,433.59	3,563.66	.3
Total	855,347.63	409,274.87	50.1
Alabama	319,797.49	155,615.15	41.7
Georgia	121,246.85	60,378.19	.8
South Carolina	1,212,313.25	541,421.98	18.0
Total	1,653,357.59	757,415.32	60.5
Grand total	10,981,155.02	5,062,205.60	268.3

TABLE 38.—*Total cost, flood relief, and mileage of roads which were completed and final payment made during the fiscal year 1932*

State	Total cost	Flood relief	Miles
New Hampshire	$196,063.55	$51,180.89	4.
Kentucky	222,666.22	67,090.75	3.1
Total	418,729.77	118,271.64	7.6
Arkansas	311,133.62	149,324.12	3.7
Alabama	266,518.77	131,129.74	38.5
Georgia	41,208.21	20,358.88	.1
South Carolina	894,427.33	403,421.98	14.5
Total	1,202,154.31	554,910.60	53.1
Grand total	1,932,017.70	822,506.36	64.4

TABLE 39.—*Total cost, flood relief, and mileage of roads under construction June 30, 1932*

State	Estimated total cost	Flood relief allotted	Miles
Georgia	$256,137.87	$123,524.70	3.6
Kentucky	332,320.08	156,426.19	30.0
South Carolina	569,884.21	244,000.00	4.3
Total	1,158,342.16	523,950.89	37.9

TABLE 40.—*Total cost, flood relief, and mileage of roads approved for construction June 30, 1932*

State	Estimated total cost	Flood relief allotted	Miles
Georgia	$129,601.70	$56,304.01	2.1
Kentucky	222,220.91	104,632.73	21.7
Total	351,822.61	160,936.74	23.8

The mileage of the several types of flood-relief roads completed in the several States during the fiscal year 1932 is given in Table 41, and the total mileages completed, under construction, and approved for construction on June 30, 1932, classified by types and by States, are given in Tables 42, 43, and 44, respectively.

TABLE 41.—*Mileage of the various types of flood-relief roads completed for which final payment was made during the fiscal year 1932*

State	Graded and drained	Sand-clay, untreated	Gravel, untreated	Portland cement concrete	Bridges and approaches	Total
New Hampshire				4.5		4.5
Kentucky	2.9				0.2	3.1
Arkansas	.2		2.3		1.2	3.7
Alabama	15.2	15.0	7.5	.1	.7	38.5
Georgia					.1	.1
South Carolina	10.0	.1		2.6	1.8	14.5
Total	28.3	15.1	9.8	7.2	4.0	64.4

TABLE 42.—*Mileage of the various types of flood-relief roads improved to June 30, 1932*

State	Graded and drained	Sand-clay, untreated	Gravel, untreated	Gravel, surface treated	Macadam, surface treated	Bituminous macadam	Portland cement concrete	Bridges and approaches	Total
Vermont			7.0	9.2		6.1	32.5	6.4	61.2
New Hampshire				2.9	4.9	2.3	18.4	.6	29.1
Kentucky	66.5							.9	67.4
Total	66.5		7.0	12.1	4.9	8.4	50.9	7.9	157.7
Arkansas	16.1		31.1				.3	2.3	49.8
Mississippi							.3		.3
Total	16.1		31.1				.6	2.3	50.1
Alabama	17.4	15.9	7.6					.8	41.7
Georgia							.4	.4	.8
South Carolina	10.1						5.3	2.6	18.0
Total	27.5	15.9	7.6				5.7	3.8	60.5
Grand total	110.1	15.9	45.7	12.1	4.9	8.4	57.2	14.0	268.3

TABLE 43.—*Mileage of the various types of flood-relief roads under construction, June 30, 1932*

State	Graded and drained	Sand-clay, untreated	Macadam, surface treated	Bridges and approaches	Total
Georgia			3.3	0.3	3.6
Kentucky	29.9			.1	30.0
South Carolina	2.9	0.3		1.1	4.3
Total	32.8	.3	3.3	1.5	37.9

TABLE 44.—*Mileage of the various types of flood-relief roads approved for construction, June 30, 1932*

State	Graded and drained	Sand-clay, untreated	Macadam, surface treated	Portland cement concrete	Bridges and approaches	Total
Georgia		0.4	0.3	1.2	0.2	2.1
Kentucky	21.6				.1	21.7
Total	21.6	.4	.3	1.2	.3	23.8

MOUNT VERNON MEMORIAL HIGHWAY

All construction and landscape work on the Mount Vernon Memorial Highway, except a few unimportant details, was completed during the fiscal year. The entire road was opened to Saturday afternoon and Sunday traffic on January 16, 1932. The section from Alexandria to Mount Vernon had previously been opened to traffic without restriction. The section from Washington to Alexandria was opened to daylight traffic late in March and to 24-hour traffic May 3, upon completion of the lighting installations.

Provision for the construction of the highway as a memorial to George Washington was made by act of Congress, approved May 23, 1928. The act authorized the United States Commission for the Celebration of the Two Hundredth Anniversary of the Birth of George Washington to survey, select, construct, and maintain the road in cooperation with the Secretary of Agriculture.

The appropriation originally authorized was $4,500,000. By act of March 4, 1931, an additional sum of $2,700,000 was authorized. All authorized funds have been expended or obligated.

The surveys and plans for the highway were made by the Bureau of Public Roads, which also has supervised the entire construction. The important work of constructing the hydraulic fills was efficiently performed by the Corps of Engineers of the United States Army. All other construction work was performed by private contractors. The landscaping and planting was done mainly by force account under the direction of the bureau.

INTER-AMERICAN HIGHWAY

A reconnaissance survey of the proposed inter-American highway from Panama to the United States was practically completed by bureau engineers during the past year. Ground surveys have been made through Panama, Costa Rica, Nicaragua, Honduras, and Guatemala, supplemented by aerial photographic surveys. Salvador is the only country among the six Republics of Central America in which survey operations have not yet been conducted.

The field force of the bureau engaged on this project has been reduced to three persons, a senior highway engineer, an assistant, and a clerk. Their headquarters have remained in the Palacio Nacional at Panama City, in quarters kindly provided by the Panamanian Government. Their work at the end of the fiscal year was centered in the preparation of a comprehensive report upon the entire reconnaissance survey.

This important project, the first step in the plan to provide continuous communication by highway between Panama and the United States, has been made possible by an act of Congress appropriating funds for a reconnaissance survey. Each of the Central American Republics in which surveys thus far have been made has officially requested that this work be performed, transmitting their requests through the Pan American Union as provided by law.

TRANSPORTATION AND ECONOMIC AND STATISTICAL INVESTIGATIONS

WESTERN STATES TRAFFIC SURVEY

Publication in March, 1932, of a Report of a Survey of Traffic on the Federal-aid Highway Systems of Eleven Western States marked the conclusion of what is probably the most extensive traffic survey ever made in the United States. The report, issued in the form of an 85-page book with a separate appendix of 13 maps in color, covers the States of Arizona, California, Colorado, Idaho, Nebraska, New Mexico, Nevada, Oregon, Utah, Washington, and Wyoming

In each of these States the survey was made with the cooperation of the State highway department.

The area of the States in this survey represents more than 37 per cent of the entire area of the United States, and includes more than 35,000 miles of Federal-aid highways. More than 20,000,000 vehicles using these highways were observed and recorded during the year of field work, the important data thus obtained including the following: Daily average of traffic, estimates of probable future growtn of traffic as of the years 1935 and 1940, classification of the different types of vehicles observed, numbers of persons transported by the passenger-carrying vehicles, the capacities of trucks, average daily length of trips, number of common-carrier and contract-carrier trucks, origin and destination of vehicles, percentages of interstate and intrastate traffic, and numerous other important facts.

Tne investigation achieved its objective of obtaining essential facts about the present density, type, capacities, and distribution of traffic units over a wide area, as a basis for planning highway development to serve present and future traffic.

MICHIGAN TRAFFIC SURVEY

Field work on a somewhat different type of survey, confined to the State of Michigan and designed to provide information regarding the character and distribution of traffic on State and local roads and on city streets, was terminated at the end of August, 1931. The work of analysis and preparation of the report is now nearing completion. Determination of the true relationship between the use of primary and secondary roads and city streets by various classes of traffic, and the source of funds employed in their improvement and maintenance, is one of the chief objectives of this survey. The observation of traffic was in progress for an entire year in 80 typical townships of Michigan, and for an additional month in 7 principal cities. The State highway department cooperated in this work.

WASHINGTON REGIONAL-AREA TRAFFIC SURVEY

At the request of numerous important groups, the bureau began in September, 1931, a 12-month survey of traffic throughout the area surrounding the District of Columbia. The agencies cooperating in this project include the National Capital Park and Planning Commission, the Maryland National Capital Park and Planning Commission, the State Roads Commission of Maryland, the Department of Highways of Virginia, the cities of Washington, D. C., and Alexandria, Va., and the counties of Arlington and Fairfax in Virginia, and Prince Georges and Montgomery in Maryland.

The purpose of this survey is to obtain information which will enable the cooperating agencies to develop a comprehensive and connected system of main highways in the Washington regional area, and a priority program of highway construction and betterment which may include suitable belt lines, relief roads, or necessary relocations and extensions of existing highways. Periodic counts of traffic are being made at approximately 250 different points.

Field work will end in September, 1932, and the work of analysis and compiling of a report will follow.

NEW HAMPSHIRE TRAFFIC SURVEY

An interesting comparison of actual present traffic with forecast estimates made five years ago was made possible by a 3-month "check" survey of traffic on the Federal-aid and State highway systems of New Hampshire between July 15 and October 15, 1931. This survey duplicated a study made at exactly the same period of the year in 1926. Results were promptly compiled. They show in brief that the classification of highways upon the basis of present and projected use is closely accurate. For the State as a whole, traffic in 1931 was 15 per cent greater than that forecast in 1926, while for routes carrying 1,500 or more vehicles per day, the actual traffic exceeded the forecast by less than 3 per cent, thus indicating the more rapid growth of traffic upon the lightly traveled routes. A statement of the factors affecting traffic growth is included in the report.

This survey was made in cooperation with the State Highway Department of New Hampshire and at its request.

INDIANA TRAFFIC SURVEY

At the request of the Indiana State Highway Commission, a sample traffic count of two weeks' duration was made in Boone County in April, 1932, to determine whether or not such information would be of value to the State legislature. The results of this trial operation were conclusive, and decision was made to conduct a 12-month survey in 11 counties of the State, field work on this extensive project being scheduled to start in August, 1932. The primary objective in this work is to ascertain the relative proportions of foreign and domestic traffic on township, county, and State roads. It will be the first extensive traffic census ever made in Indiana, although counts have been made on a few of the roads approaching Chicago in the extreme northwest corner of the State.

NEW JERSEY TRAFFIC SURVEY

Toward the end of the fiscal year, the State Highway Commission of New Jersey completed arrangements with the bureau to direct a 12-month traffic census throughout the State, and field work was scheduled to start in August, 1932. The survey is designed to obtain data on the flow of traffic over the entire State highway system, and on a limited mileage of principal county roads as well. Incorporated with it will be a special study of truck traffic which is expected to provide the most detailed and accurate information thus far available on this important portion of highway traffic. The data sought will include origin and destination of trucks, their nominal capacities and body types, their classification as private operators, contract carriers and common carriers, and whether operating interstate or intrastate. A supplementary feature of the survey will be a time study of delays to traffic on the present route across the meadows between Jersey City and Newark, in order to furnish an accurate comparison with delays after the opening of a new viaduct now being constructed to serve the same route and traffic.

TRAFFIC CAPACITY AND INTERSECTION STUDIES

A study of highway capacity, made under a cooperative agreement with the University of Maryland, was completed during the year, and the results were printed in Public Roads for May, 1932. Observations extended through 1930 and 1931, and covered numerous heavy traffic routes along the eastern seaboard between Massachusetts and Virginia. The conclusions, in general, were to the effect that the traffic capacity of a 3-lane road is twice that of a 2-lane road, and the 4-lane road has a capacity at least three times that of a 2-lane road; or, expressed in figures, traffic capacities of 2-lane, 3-lane, and 4-lane roads are, respectively, about 1,000, 2,000, and 3,000 vehicles per hour. Adding one lane to a 2-lane road increases its width 50 per cent and its capacity 100 per cent; and doubling the width of a 2-lane road triples its capacity.

The bureau is actively interested in the design of intersections to reduce traffic congestion and in the efficiency of various types of traffic control devices at intersections.

During the year a digest of a report on intersection designs was prepared for publication and appeared in the July, 1932, issue of Public Roads. This report was prepared by bureau representatives at the Albert Russel Erskine Bureau for Street Traffic Research, Harvard University.

At the request of the city of Alexandria, Va., a traffic survey was conducted in June, 1932, to determine means of relieving the congestion on Washington Street, which now carries the traffic of the recently completed Mount Vernon Memorial Highway through Alexandria. A plan for suitable control at intersections, proper timing of traffic signals, and necessary regulations was prepared, based upon detailed traffic counts at a number of intersections on Washington Street.

A study is now in progress to determine the delay to vehicles caused by various types of traffic control, and to ascertain the conditions to which the common types of control are best adapted. By means of an electrical time recorder observations of time loss have been completed at several intersections where traffic was controlled by officers, fixed time signals, coordinated signals, and traffic-actuated signals. During the coming year these studies will be continued to include numerous other intersections and a variety of traffic conditions.

STUDIES OF TAXATION IN WISCONSIN, MICHIGAN, ILLINOIS

Tax studies in cooperation with the department of economics of the University of Wisconsin have been continued during the year. The Wisconsin study has been completed and the report is ready for publication. The field work for Michigan has been finished and the report is well advanced. In Illinois field work should be completed early in the new fiscal year. In all these studies the purpose is to establish the relation of the highway taxes paid from different sources and by different groups of citizens based on local administrative units and the highway service furnished. The studies will establish a broad basis for adjustment of highway taxes on a rational plan.

STUDY OF COMMERCIAL-TRUCK OPERATION

An investigation of commercial-truck operation in all parts of the United States, conducted in cooperation with the Bureau of Foreign and Domestic Commerce of the United States Department of Commerce, was completed and the resulting report delivered to the printer. Publication is scheduled for August, 1932.

Data regarding various factors of motor-truck operation were supplied by 217 operators of intercity common-carrier and contract-carrier trucks in 41 States and the District of Columbia. The average rated capacity of the vehicles covered by the survey was found to be 2.88 tons, 60 per cent being rated at 1½ to 3 tons capacity and 29 per cent at 3½ tons or over. Only 2½ per cent of the 1929 and 1930 model trucks were equipped with solid tires. Regularly scheduled trips were reported over fixed routes exceeding 500 miles in length, but the average length of route was only 70 miles, with 75 per cent of the routes less than 110 miles. Tabulations of motor-truck unit and fleet operating costs were also presented, accompanied by a general discussion of motor-transportation costs.

TESTS OF HIGHWAY SIGNS

In an effort to determine the comparative efficiency of various types of highway signs, a series of tests has been conducted with the cooperation of the Bureau of Standards, United States Department of Commerce. Photometric tests are in progress on numerous types of "reflector buttons" with reference to percentages of reflection under standard automobile headlights of given candle power, the angle of reflected arc, and the general efficiency of the buttons when inserted in sign legends, having regard to minimum impairment of daylight values. Standard highway signs with various color combinations of yellow, black, and white are also being tested by means of personal visual observation to establish the relative values of colors, legend, and background. These tests will continue into the next fiscal year, and results will be published upon their conclusion.

PRODUCTION COST STUDIES

It has been well established that under ordinary conditions the daily or hourly cost of operating almost any of our modern road-building plants is practically independent of the rate of operation. The most effective way to reduce unit operating costs is to increase the rate of production; for, as the rate of production increases, the unit cost of the work decreases in nearly the same ratio. Studies have therefore been carried on during the past year to determine more definitely the lines along which production rates can be still further increased without injury to the quality of the product.

EXPERIMENTS WITH ROLLED CONCRETE

This work must necessarily be limited almost entirely to field studies and analysis of going projects and to occasional practical field demonstrations of the means and methods giving most definite promise of practical value. One of these newer methods is the experimental development of rolled concrete in the production of which an ordinary tandem road roller of about 5 or 6 tons weight is utilized to consolidate a very dry and lean concrete mix laid as a pavement. In point of density, beam strength, and surface smoothness, the result compares favorably with present standard mixes containing a far greater proportion of cement and sand. In this way, satisfactory results have been obtained from concrete in the proportioning of which from 0.85 to 0.95 cubic yard of gravel or broken stone was utilized for each cubic yard of consolidated concrete pavement.

This development, while still only in the experimental stage, may be described as essentially a practical method of handling and placing a mix in which the

mortar, of about normal richness and of low water content, is only sufficient to fill the voids of the coarse aggregate when the aggregate is thoroughly consolidated by repeated rolling with a 5 or 6 ton tandem road roller. The only additions to the regular and customary equipment generally used in concrete pavement construction are the tandem road roller and an extra finishing machine. The usual methods of proportioning, mixing, and handling are identical until after the pavement has been struck off by the first finisher. This strike off is sufficiently higher than normal so that the roller will just compact the remaining concrete to the height of the forms.

Immediately after spreading, the rolling is begun and carried on in much the same manner as in the construction of macadam surfaces. This rolling is continued until the surface is perfectly smooth and unyielding and all particles are firmly interlocked and the mortar is just flushing to the surface.

The second finishing machine is then used to screed the surface, distributing the local excess mortar and removing minor roller markings in the surface mortar, and thus producing a surface similar in general appearance to that obtained by the usual methods.

BITUMINOUS LOW-COST ROAD STUDIES

Considerable attention has also been devoted to the low-first-cost bituminous types of construction. In respect to the plant-mix types work has been devoted largely to finding means of maintaining production rates in the face of the tendency to add to these types of construction much the same refinements as are required in the standard asphaltic or bituminous concretes. Further work should be done to determine the cost of many of these requirements and also what value, if any, they impart to the finished product. Otherwise there is danger of gradually removing this type of construction from the low-first-cost field and adding another type to the large field of standard or medium priced types.

Studies of bituminous road-mix types have been devoted largely to finding ways and means of simplifying and standardizing construction procedures and to the development of more effective and efficient mixing equipment. Progress in these efforts has been gratifying and gives promise of definite results.

An extensive field study of the size of the batch of Portland-cement concrete which can be mixed in standard 27E pavers without detriment to the quality of the product or uniformity of the mix was concluded and reported in Public Roads for January, 1932.

GRADING STUDIES

To aid bidders on grading projects in analyzing the exact nature of the work involved, complete field studies were made of two large grading projects and complete advance plans of construction operations were prepared and distributed to prospective bidders with copies of the usual construction plans. Present indications are that these advance construction plans were of definite value not only to the contractors but also to the State and Federal Government, and that further studies should be made to determine fully whether or not such plans should form a part of the regular procedure in the preparation of the usual construction plans for all grading projects before bids are called for.

Studies extending over a period of nearly eight years have shown that in highway-grading work involving the removal of solid rock the drilling and blasting is usually organized and conducted with less efficiency than other operations. To aid in remedying this condition a careful study was made of the bureau's experiences, and the conclusions and suggestions were published in Public Roads for February, 1932.

LABOR'S SHARE OF ROAD-BUILDING EXPENDITURES

For years the question has been raised as to the extent to which labor profits from the construction of high-type pavements in which mechanical equipment plays an important part. During the past two years answer to this question has been needed in formulating legislation and planning construction programs. A thorough study was therefore made, in which the money paid out by States and communities for the construction of concrete pavements was traced through its various exchanges. The concrete pavement was chosen because it represents not only one of the most highly mechanized forms of construction but is also one of the more widely used of the higher types of pavement. This study, of which a report was published in Public Roads for April, 1932, shows that, although only about 15 per cent of each dollar expended by the State or com-

munity is paid directly to the labor on the job, from 80 to 90 per cent eventually reaches labor in the form of wages and salaries.

When highway expenditures were thus traced through all the ramifications of sand and gravel pits, stone quarries, cement and steel mills; of manufacturers of equipment, repair parts, explosives, gasoline, lubricating oils, and supplies; of railroad and transportation companies, and those who furnish their equipment, repairs, and supplies from coal and ore mines through mills and factories, not only was it found that about 90 per cent of the taxpayer's dollar had been returned to labor in wages and salaries, but also that a very large part of the industry of the country had taken an active part in the work and had received a definite financial stimulus.

The regular collection of information in regard to the number of persons employed on Federal and State highway construction and maintenance was continued.

HIGHWAY ACCOUNTING METHODS

During the year cooperation was continued with the State highway departments in the further development or installation of more efficient and uniform accounting and statistical procedures in order to provide the administrative and engineering organizations with full and complete records of current income, expenditures, and accomplishments in highway construction, maintenance, and administration. Based on the use of modern bookkeeping and tabulating equipment and guided by standard definitions of the various activities in which the several highway departments are engaged, the aim is to provide a system of accounts and records which will not only fully meet all the accounting requirements of the department but will also provide quickly and in practical form complete statistical information on any desired activity in which the department is engaged. The general adoption of a uniform system of accounts and records should be of great value not only to the individual States in planning and carrying on their activities but should also be of still greater value in making possible an intelligent comparison of the cost of various methods and kinds of road construction and maintenance as carried on in the several States. Such a comparison is as yet largely impossible, except in a few States, because of the dissimilar form of the available records and the lack of a uniform nomenclature and procedure.

During the year such work has been carried on in cooperation with the highway departments of Georgia, Indiana, North Carolina, and Ohio.

PHYSICAL RESEARCH

MOTOR-VEHICLE-IMPACT INVESTIGATIONS

The motor-vehicle-impact research which has been carried on for the past several years in cooperation with the Rubber Manufacturers' Association and the Society of Automotive Engineers was continued during the past year. A comprehensive study was made of the impact reactions produced by a modern, long-wheel-base vehicle, equipped with balloon tires, particularly when traveling at high speeds. This vehicle, a powerful bus chassis, was driven over both artificial obstructions and natural road roughness at speeds up to about 70 miles per hour. The purpose of this part of the tests was to determine not only the magnitude of the impact reactions developed at these high speeds but also to determine the trend of the relation between vehicle speed and the magnitude of the reaction. Definite data were obtained on both of these questions.

In addition, a comprehensive study was made of the relation between the magnitude of the impact reaction and the frequency of occurrence on typical road surfaces. For this purpose two groups of road surfaces were selected which covered, for both the bituminous and concrete types of construction, the range from the smoothest to the roughest to be found in service in the vicinity of Washington, D. C. The test vehicle was driven over each of these at certain specified speeds and actual counts made of the number of reactions of each magnitude which occurred. These data present a clear picture of the number and magnitude of the principal impact forces which road surfaces of different degrees of roughness are called upon to withstand. A report of these studies has been prepared for publication at an early date.

This investigation virtually completes the researches which had for their object the determination of the magnitude of motor-vehicle-impact reactions and

of the major influencing factors. Attention is now being turned to the equally important question of the effect on road surfaces of the suddenly applied forces of motor-vehicle impact.

INVESTIGATION OF CONCRETE PAVEMENT DESIGN

The study of the behavior of the 10 full-size concrete pavement slabs, described in last year's report, has been carried on continuously throughout the year.

The investigation divides naturally into three main parts: (1) A comparison between theoretical and observed behavior of slabs of uniform thickness subjected to static loads; (2) a comparison of the relative load-carrying capacity of the several cross-section and joint designs which are included; and (3) a study of the effects of temperature on the size, shape, and load resistance of pavement slabs.

Several years ago a theoretical analysis of the stresses in road slabs by H. M. Westergaard was published by the bureau. This analysis is now being subjected to the test of physical research. A very careful study of the theory is being made in the hope that a perfected rational method of design may result. Definite data are being obtained on the relative load resistance of the different slab designs, and information concerning temperature effects is nearly complete. It is planned to make the information which is being obtained available in separate reports, each covering completely one part of the investigation.

INVESTIGATIONS OF CONCRETE AND CONCRETE AGGREGATES

The studies of the quality of paving concrete, mixed and placed under actual working conditions, have been continued by including (1) an investigation of the effect of using high-speed vibrators for compacting concrete, (2) the effect of continued surface manipulation of the concrete in order to remove excess water and to consolidate the mass, and (3) the effect of using hydraulic lime as an admixture.

The test procedure was substantially the same as that employed in connection with the investigation of concrete proportions and consistency reported last year and involved the construction of a test pavement 9 feet in width and approximately 1,700 feet in length. The tests have been completed, and a report will be issued during the coming year. A preliminary analysis of data indicates that under certain conditions the strength and density of paving concrete is somewhat improved by the use of vibrators of the type employed in these tests and that the strength and density of paving concrete is quite materially improved by the continued manipulation of the surface in order to eliminate excess water. On the other hand, the use of hydraulic lime as employed in these tests did not produce any beneficial effects. In general, the tests substantiate to a marked degree the conclusion given in last year's report regarding the relationship between the consistency of the concrete and the strength and uniformity of the pavement slab. This conclusion was to the effect that

when very dry mixtures are used (less than 2-inch slump) the strength of the pavement slab will be lower and the amount of honeycomb in the concrete will be greater than when concrete of medium consistency is employed (2 to 3-inch slump).

Some progress may be noted in connection with the general study of factors affecting the durability of concrete. One investigation, which was designed primarily to study the effect of type and character of coarse aggregate upon the resistance of concrete to frost action, has been completed and a report issued. Data obtained from this and other investigations of a similar nature conducted by the bureau substantiate the conclusions reached by other investigators that the resistance of concrete to weathering is very materially affected by the amount of water used in the mixture. The tests indicate further that, within a wide range of aggregate types and characteristics, the quantity of water used in the mixture is of more importance than the kind of aggregate.

The investigation of methods of making flexure tests of concrete, to which reference was made in last year's report, has been completed and a report prepared. The data show conclusively that, if comparable results are to be obtained by various laboratories, certain variables, such as size of specimen, method of loading, etc., must be standardized. Recommendations for the use primarily of committees of the American Association of State Highway Officials working on this problem are made in the report.

Question has been raised as to whether, due to increased chemical activity, the new high-early-strength cements now being extensively used in highway construction will not deteriorate if kept in storage for a considerable time before use. In order to determine this point an investigation was started by the bureau in

which three well-known examples of this type of cement were tested in concrete after being subjected to storage conditions closely paralleling ordinary warehouse storage for various periods ranging from 1 to 11 months. The results indicate that, under ordinary conditions, this type of cement may be safely stored for several months without impairing the high-early-strength characteristics.

HIGHWAY BRIDGE INVESTIGATIONS

The report of the bridge-floor-slab tests carried on in cooperation with the Port of New York Authority, mentioned in last year's report, was published during the past fiscal year.

The report of the impact and static load tests of two bridge-floor slabs of a special type conducted in cooperation with Allegheny County, Pa., which was noted in the last annual report, has been prepared for publication in Public Roads in September, 1932.

An investigation has been started which has for its object the determination of the relative resistance to sliding of bridge bearing plates of various metals.

The field work on the investigation of the Freyssinet method of concrete-arch construction in cooperation with the Oregon Highway Commission was completed in November, 1931, when the Rogue River bridge was opened to traffic. The superstructure of the bridge was begun in May, and jacking operations were started on the first two spans in September after the spandrel structure had been in place 30 days.

The actual behavior of the arches, as determined from accurate measurements of deformations and strains, did not agree with the theoretical behavior of the structure because the spandrel structure offered considerable restraint to the ribs even though it was completely articulated for the purpose of eliminating this restraint. However, by the proper combination of moment and thrust introduced with the jacks at the crown, the stresses were made to confrom approximately to the theoretical stresses. Tests on plain concrete specimens indicated that an eventual shrinkage of about seven ten-thousandths inch per inch could be expected in the ribs if complete drying of the concrete should occur. The effect of this shortening of the axis was compensated by the introduction of bending of an opposite sense at the points of maximum stress.

The problems of technic of the application of the method were studied and solved and much valuable data on the behavior of an arch during and immediately following decentering were gathered.

A complete report on the results of this investigation will be available in the near future.

LOW-COST ROAD INVESTIGATIONS

During the past year the bureau has continued to observe the experimental highways previously constructed in cooperation with the State highway departments of California, Nebraska, and South Carolina, and described in previous reports. Although no new construction of experimental sections has been undertaken by the bureau, the development of satisfactory surfaces of low cost for secondary roads is still considered a subject of foremost importance, and such information as is being obtained from the observation of these cooperative projects and other surveys of low-cost types should prove of value in the selection of satisfactory materials and methods of construction for roads of this character.

The experimental project in California, conducted in cooperation with the California Department of Public Works, has now been in service for a length of time sufficient to warrant a report in the near future on its construction and behavior and the information obtained from the sections included in this project should be of considerable value in the design of future construction of these types.

The experimental road constructed by the mixed-in-place method in the sand-hill area of Nebraska has been under particularly close observation to determine the type of construction best adapted to very sandy soils. A report on the construction and early behavior of the various sections will be prepared for publication in Public Roads in the near future.

Of the three projects constructed and maintained by the South Carolina Highway Department in cooperation with the bureau, one has been discontinued. A final report on the behavior of the various sections of this project has been prepared for early publication. A progress report on the construction and early behavior of various bituminous surfacings on marl and sand-clay bases was published during the past year. The mixed-in-place construction, which involved the use of fine-graded material, is still under observation and a report on the construction, maintenance, and behavior is being prepared.

The cooperative investigation of low-cost tar-treated roads by the bureau and representatives of the tar industry has been continued. A final report on this work in North Carolina is being prepared. In this report an attempt has been made to correlate the service behavior of the surface-treatment type of construction with laboratory analyses of the widely different types of subgrades and base materials on which these treatments were built.

A field survey and necessary laboratory work in connection with the tar-bound roads in Pennsylvania have been completed. A report on this work will be prepared during the coming year.

In studying the behavior and relative value of the low-cost roads it has been found exceedingly difficult to compare work done in various States because of the dissimilarity of the bituminous materials used and the lack of uniformity in specifications for these bituminous products. With the cooperation of the States and the asphalt industry, the bureau has undertaken the task of simplification of tests and standardization of specifications for those liquid asphaltic products which are extensively used in low-cost construction.

During the past year all States and many producers cooperated in testing a large number of fluid asphaltic products by the methods prescribed in their own various specifications and also by methods proposed for use in a common simplified scheme. The data obtained were assembled by the bureau and presented to the States and producers. At a series of regional meetings of State and producer representatives the data were considered and the simplified scheme was generally adopted, with some retention of the old tests, by those who were not as yet willing to discard them for the proposed scheme of analysis. However, satisfactory progress in the elimination of unnecessary tests has been made, and this important work will be continued during the coming year.

SUBGRADE INVESTIGATIONS

Work of the past year has completed the first phase of the subgrade investigations, and a second phase has been inaugurated. A series of reports has been published covering the following basic subjects: (1) A discussion of soil properties of importance in respect to subgrade performance; (2) the significance of the simplified soil tests as means of disclosing the presence of important soil properties; (3) the methods of making soil tests; and (4) the importance of the soil profile in the solution of subgrade problems, as revealed by field surveys.

Activities are now being centered on the practical application of the information thus far gained. The utilization of locally available materials for the construction of stable topsoil, sand-clay, and gravel surfaces or foundations for bituminous treatments is a problem receiving major attention. A theoretical conception of the composition and the properties of the component parts of satisfactory stable mixtures has been formulated. On the basis of this theory, supplemented by laboratory investigations of samples of known constructional value, specifications are now being prepared which are comprehensive in scope and will permit the utilization of roadside materials to the best advantage.

The possibility of improving combinations of natural soil materials by admixtures which by their physical composition or chemical reaction will furnish the necessary balance of soil properties has long been apparent. A series of investigations is now being made to determine the extent of the possibilities in this direction. In choosing the admixtures experience as well as theory has been drawn upon. Thus, the cemented ferruginous gravels suggested a precipitated-iron compound. The manufacture of artificial stone suggested the addition of calcium chloride subsequent to a treatment with sodium silicate. Very lean bituminous emulsions and Portland cement also may prove beneficial as admixtures in many instances.

These investigations are not confined to the laboratory but will include outdoor models to indicate the behavior under climatic changes as well as the construction methods required to produce the proper admixture.

To furnish the designer with tangible evidence of the drainage properties of soils a device known as a drainage indicator has been developed. The drainage indicator discloses among other data the following: (1) Relative portions of soil particles, capillary moisture, gravitational moisture and air in either disturbed or undisturbed soil samples; (2) the rate of capillary rise at any distance above ground-water elevation; (3) the rate of gravitational flow under any head; and (4) the maximum capillary rise.

Present practice in connection with soils known to be associated with detrimental frost heave is to excavate to the depth of frost penetration and back fill

with selected material. In some localities such a procedure would be so expensive as to become prohibitive. As frost heave may occur only upon loss of heat from the subgrade through the pavement, and as many inexpensive substances have lower coefficients of thermal conductivity than materials used in pavement construction, plans have been made for a series of controlled, large-scale, outdoor experiments in the northern parts of the country to determine the value of insulating layers for the prevention of the heat loss and resulting heave.

In connection with the disintegration of certain concrete pavements a field survey has been made and microchemical investigations of the subgrade soil, soil water, and concrete have been conducted.

The number of subgrade samples submitted for analysis from active Federal-aid projects has increased materially during the past year. Further indication of growing appreciation of the importance of a proper utilization of soil support in road building may be found in the fact that 13 State highway departments have sent representatives to the subgrade laboratory of the bureau at Arlington, Va., to take advantage of the courses of instruction in field and laboratory procedures and the interpretation of tests which the bureau there provides.

Ten State departments have indicated that they are , at least in some instances, making subgrade surveys prior to construction, while six others have laboratories equipped to make the simplified soil tests. Subgrade specialists of the bureau have visited eight States to assist in the organization of subgrade divisions in the highway departments.

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REPORT OF THE CHIEF OF THE BUREAU OF PUBLIC ROADS, 1933

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF PUBLIC ROADS,
Washington, D.C., September 1, 1933.

SIR: I submit herewith the report of the Bureau of Public Roads for the fiscal year ended June 30, 1933.

Respectfully,

THOMAS H. MACDONALD, *Chief.*

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

The mileage of Federal-aid road construction during the fiscal year 1933 was less than the mileage constructed in the preceding year but greater than in any other year. The aggregate length of the projects completed was 13,255.3 miles, of which 8,503.3 miles were included in initial-construction projects, 4,700.5 miles in stage construction, and 51.5 miles in reconstruction projects.

The projects inaugurated during the year reduced to little more than $15,000,000 the unobligated balance of all Federal-aid appropriations thus far authorized, and to slightly more than $3,000,000 the special emergency appropriation of $120,000,000 made less than a year previous.

For the first time in 17 years the fiscal year ended without definite provision by Congress for the continuance of the program of Federal-aid road construction. In place of the usual authorization, provision was made in the National Industrial Recovery Act, approved June 16, 1933, for the construction of highways as a means of furnishing employment during the fiscal year 1934. For this purpose there was appropriated $400,000,000 to be expended on Federal-aid roads and extensions thereof into and through cities and on secondary and feeder roads in all States, and an additional sum of $50,000,000 for forest and park roads and roads in Indian reservations and through public lands.

Rules and regulations governing the expenditure of the $400,000,000 appropriation were issued June 23, 1933.

EMERGENCY APPROPRIATIONS AND EMPLOYMENT

Under the provisions of the Emergency Relief and Construction Act of July 21, 1932, $120,000,000 was made available for emergency-construction work on the Federal-aid highway system. The act required apportionment of the appropriation among the several States and Hawaii in accordance with the regular Federal-aid formula, to be used as a temporary advance, and in lieu of State funds, to match the regular annual Federal-aid funds available to the States. It was further provided that the sums advanced should be reimbursed to the Federal Government by deduction from future Federal-aid appropriations over a period of 10 years commencing with the fiscal year 1938.

The construction season of 1932 was far advanced when these funds became available. As a result the rate of expenditure was at first considerably slower than it would have been had the appropriation been provided earlier in the year. With the object of insuring prompt expenditure and quickly increased employment the act stipulated that the money should be advanced only for work performed before July 1, 1933. It soon became apparent that expenditure of the entire appropriation by the date set would be virtually impossible, and the time of availability was extended to January 1, 1934, by an amendment in the Agricultural Appropriation Act, approved March 3, 1933.

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U. S. SUPERINTENDENT OF DOCUMENTS

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As shown by table 1, actual disbursements of these funds to the States to June 30, 1933, the original terminal date, amounted to $62,131,961.24. An additional amount, estimated at $23,122,000, had been earned by the completion of work, which will be paid on receipt of the vouchers of the State highway departments.

TABLE 1.—*Emergency construction apportionment, and amounts paid to States for fiscal year 1933, and unobligated balance of apportionment, June 30, 1933*

State	Emergency construction apportionment	Paid to States during the fiscal year 1933	Unobligated balance of apportionment on June 30, 1933
Alabama	$2,558,229	$1,463,650.73	$115.57
Arizona	1,760,771	1,227,945.74	22,765.87
Arkansas	2,101,182	798,562.89	54,222.91
California	4,667,188	3,396,566.14	190,944.52
Colorado	2,258,613	1,178,167.24	288,368.28
Connecticut	778,806	199,301.99	5,822.36
Delaware	600,000		
Florida	1,624,752	999,893.39	2,417.96
Georgia	3,123,298	2,383,353.97	95,528.97
Idaho	1,505,912	759,959.46	101,608.12
Illinois	5,082,847	1,378,516.99	9,583.51
Indiana	3,058,980		252,947.45
Iowa	3,171,504	2,403,987.98	84,421.60
Kansas	3,265,048	2,064,898.57	268,110.53
Kentucky	2,264,637	965,178.40	45,581.41
Louisiana	1,745,559	1,158,469.56	
Maine	1,067,079	390,016.06	29,067.60
Maryland	1,019,570	427,495.73	
Massachusetts	1,716,612	767,048.69	
Michigan	3,779,706	1,798,198.57	89,446.58
Minnesota	3,368,559	1,736,320.72	
Mississippi	2,160,164	658,279.26	55,479.51
Missouri	3,753,453	1,570,921.22	4,458.66
Montana	2,525,071	1,637,171.24	2,840.77
Nebraska	2,544,773	2,076,085.45	20,553.11
Nevada	1,575,756	959,697.77	265,660.66
New Hampshire	600,000	226,423.26	89,000.48
New Jersey	1,657,733	859,687.32	
New Mexico	1,965,473	1,669,349.87	38,274.28
New York	6,059,238	2,527,212.34	
North Carolina	2,888,251	1,628,859.21	
North Dakota	1,933,901	873,888.73	124,186.74
Ohio	4,490,175	2,079,240.12	254,412.21
Oklahoma	2,888,723	1,184,770.09	337,047.03
Oregon	2,001,740	946,288.34	246.54
Pennsylvania	5,267,060	2,249,237.37	22,800.00
Rhode Island	600,000	388,068.04	
South Carolina	1,666,755	1,062,821.18	14,070.08
South Dakota	2,004,573	1,217,751.66	1,349.19
Tennessee	2,605,160	1,741,663.14	45,000.00
Texas	7,664,621	3,369,028.47	25,434.98
Utah	1,395,331	628,690.11	8,812.78
Vermont	600,000	258,344.56	200.00
Virginia	2,256,178	1,163,685.76	234,125.19
Washington	1,920,470	1,206,890.62	117,757.76
West Virginia	1,323,912	869,397.98	43,927.28
Wisconsin	2,991,076	2,003,172.96	1,252.96
Wyoming	1,541,561	1,084,939.98	9,682.73
Hawaii	600,000	492,862.37	492.31
Total	120,000,000	62,131,961.24	3,258,018.49

Of the total appropriation only $3,258,018.49 remained unobligated at the end of the year, and three fourths of this amount was credited to 11 States. Nine States—Delaware, Louisiana, Maryland, Massachusetts, Minnesota, New Jersey, New York, North Carolina, and Rhode Island—had obligated the total amounts of their apportionments, and several other States had negligible balances.

Of the funds obligated, $4,502,467.38 had been paid on projects completed and fully paid for; $9,032,380.76 had been allotted to projects which had been completed, but for which the final payment had not been made; $98,477,405.61 was obligated to projects that were under construction at the end of the year, and $4,729,727.76 to projects that had been approved for construction.

The effect of the emergency appropriation upon employment afforded by highway work is shown in table 2. The table shows in adjoining columns the numbers of men employed in each month of the fiscal years 1932 and 1933 on all Federal and Federal-aid construction and on all Federal and State road work including

State-maintenance operations. The Federal-employment figures include the relatively small numbers of men employed on national-forest and national-park road construction in addition to much larger numbers employed on Federal-aid and emergency Federal-aid projects.

TABLE 2.—*Comparison of employment during the fiscal years 1932 and 1933 on all Federal and Federal-aid highway construction and on all Federal and State road work, including State maintenance operations, by months*

Month	Men employed on all Federal and Federal-aid highway construction		Total men employed on all Federal and State highway construction and maintenance	
	Fiscal year 1932	Fiscal year 1933	Fiscal year 1932	Fiscal year 1933
July	164,708	81,042	385,349	305,372
August	151,418	89,346	389,949	333,403
September	116,100	122,193	356,617	374,405
October	88,869	124,106	330,104	373,246
November	62,466	129,933	289,316	371,667
December	35,991	98,271	244,971	290,465
January	29,518	75,498	229,189	266,443
February	26,673	78,215	218,218	255,256
March	28,008	95,704	211,549	279,213
April	42,205	122,256	245,843	299,882
May	59,008	139,831	259,615	330,138
June	71,772	152,276	280,636	359,605

The effects of two emergency appropriations are noticeable in table 2. In July and August 1931—the first 2 months of the fiscal year 1932—the $80,000,000 emergency appropriation of December 20, 1930, was still in course of expenditure. In the corresponding months of the fiscal year 1933, the expenditure of the $120,000,000 emergency appropriation of July 21, 1932, had not begun, and the regular Federal-aid appropriations were the only Federal funds available. A comparison of the employment on Federal projects in these 2 months of one fiscal year with the same months of the other shows that employment in the fiscal year 1932 period when the first emergency appropriation was being expended, was almost twice that of the similar 1933 period when only the regular Federal-aid appropriation was available.

The figures for total Federal and State employment in the last two columns of the table show that the additional employment made possible by the Federal emergency appropriation in the 2 months of the fiscal year 1932 was effective in increasing total employment. In July 1931, employment on Federal projects exceeded the similar employment in July 1932 by 83,666 men. The corresponding difference in total employment was 79,977. In August 1931 the Federal employment exceeded similar employment in August 1932 by 62,072, and the corresponding difference in total employment was 56,546. It is apparent that the greater total employment on all Federal and State highway work in July and August 1931, as compared with the same months of 1932, was due very largely to the Federal emergency appropriation.

In the remaining months of the 2 years the situation is reversed, and the greater employment figures are without exception recorded in the fiscal year 1933. In this connection, it will be recalled that the availability of the $80,000,000 emergency appropriation terminated on September 1, 1931, and that the $120,000,000 appropriation became available on July 21, 1932. Federal employment fell off sharply after August 1931 and increased markedly in September 1932. For every month after the latter month the effect of the $120,000,000 appropriation is clearly indicated by the excess of employment over the corresponding month of the preceding year when no emergency appropriation was available; and the average increase on Federal and Federal-aid work was reflected in large part in an increase in total employment.

During the last 10 months of the fiscal year 1932 the total Federal employment was 560,610 man-months. In the corresponding period of the fiscal year 1933 there was a total employment of 1,138,283 man-months, a gain, due mainly to the $120,000,000 emergency appropriation, of 577,673 man-months, or more than 100 percent of the 1932 total.

In the same two 10-month periods the total Federal and State employment was 2,666,058 man-months in 1932 and 3,200,320 man-months in 1933. The 1933 gain, 534,262 man-months, is slightly less than the gain in Federal and Federal-aid work, indicating that the employment increase provided for by the Federal emergency appropriation may have been partly offset by a drop in the employment possible with State funds.

Table 2 shows that Federal and Federal-aid work gave employment throughout the winter of 1932–33 to more than twice as many men as had been employed on the same kind of work the preceding winter, and it also shows that this additional Federal employment had the effect of raising the total winter employment on highway work. From the sharp increase in Federal employment in September 1932, less than 2 months after the passage of the Emergency Relief and Construction Act, it is apparent that the benefits of the emergency funds were very quickly felt by labor.

PROGRESS IN FEDERAL-AID ROAD CONSTRUCTION

Initial improvements were made during the fiscal year on 8,503.3 miles of the Federal-aid highway system; advanced stages of improvement were constructed on 4,700.5 miles; and 51.5 miles previously improved were reconstructed. The total mileage constructed was therefore 13,255.3 miles. This is less than the 15,997.2 miles constructed during the preceding year but exceeds the mileage constructed in any other year.

As explained in the report for the fiscal year 1932 the improvements classed as completed and included in the above total mileage figures are not only physically completed but have also been paid for by the Federal Government to the full extent of its obligation. In addition to these projects, there were others on which at the end of the year all construction work was completed to the satisfaction of the Bureau, and only the final payment by the Federal Government remained to be made before classifying them as completed. They are separately classified only because, until the final voucher has been paid, it is not possible to report exactly the total cost and Federal payment. In projects of this class there were at the end of the fiscal year 1933, 2,171.6 miles of initial construction, and 1,166.9 miles of stage construction, a total of 3,338.5 miles, exceeding by 407.6 miles the total similarly classified in the fiscal year 1932.

At the close of the year, construction of initial improvements was in progress on 8,397.4 miles, and other initial improvements had been approved for 522.5 miles. Stage construction was in progress on 3,970.3 miles already initially improved with Federal aid, and similar advanced improvements had been approved for 236.7 miles. In addition, 15.9 miles previously improved were in process of reconstruction.

The active construction program at the close of the year involved a total of 12,383.6 miles, as compared with a total of 10,511.9 miles the year previous. The increase this year is attributable to the $120,000,000 appropriation made by the Emergency Relief and Construction Act of 1932. On the other hand, the additional mileage on which improvements have been approved, totaling only 759.2 miles at the close of last year, is much smaller than the 4,076.2 miles at the corresponding stage of the year before. This is explained by the near approach to complete obligation of all available Federal-aid and emergency advance funds at the close of last year.

The total mileage on which initial improvements had been constructed and final payment made by the Federal Government up to the end of the fiscal year 1933 was 109,683.4. In addition there were 2,171.6 miles which were constructed and opened to traffic but not yet completely paid for on the part of the Federal Government. Initial improvements had, therefore, been physically constructed with Federal aid on 111,855 miles of the system on June 30. At that time, however, 3,986.2 miles included in the above were undergoing stage construction or reconstruction and were temporarily removed from the mileage open to travel, so that the mileage classified as completed on June 30, 1933, was only 107,868.8 miles, which is a net increase of 6,836.7 miles over the corresponding mileage on June 30, 1932. The location of this mileage by States is shown in table 12. Its classification by types, as built with Federal aid, and its location are shown in table 17.

STAGE CONSTRUCTION

Although the mileage of stage construction during the year was less than the mileage during the preceding year by about 225 miles, the ratio of stage construction to initial construction increased sharply. The 4,700.5 miles on which stage construction operations were completed represented 55.3 percent of the mileage of initial construction, as compared with 44.6 percent, the corresponding ratio of the year immediately preceding.

As explained in previous reports, works classified as stage construction are supplementary improvements, paid for in part with Federal aid, of roads previously improved to lesser degree as Federal-aid projects. In most instances it is work deliberately deferred at the time of original improvement, and definitely forecast and agreed upon as a future necessity in the original agreements with the State highway departments. Many such projects involve the deferred surfacing of roads previously graded and drained. In no case is the total Federal expenditure on any project increased by the additional allotment beyond the limit of payment per mile fixed by law.

It may be necessary to explain again, as in previous reports, that the plan of stage construction is a considered policy designed to permit extension of some degree of improvement as rapidly as possible with the funds annually available to the entire Federal-aid system with provision for further and more adequate improvement as funds subsequently are made available. As shown by table 3, the ratio of such supplementary work to initial improvements has steadily increased since it was first recorded in 1923, when it was only 1.2 percent. This increase from year to year is the natural result of the shrinkage of unimproved mileage within the system and the development of the occasion and opportunity for further improvement of the previously constructed mileage.

TABLE 3.—*Mileage of initial construction, stage construction, and reconstruction projects completed and final payment made, by fiscal years 1923–33*

Fiscal year	Mileage of initial construction completed and paid for	Stage construction completed and paid for		Reconstruction completed and paid for		Mileage of total construction
		Mileage	Percentage of initial construction	Mileage	Percentage of initial construction	
1923	9,940.5	117.8	1.2			10,058.3
1924	9,145.6	280.7	3.1			9,426.3
1925	9,437.1	495.3	5.3			9,932.4
1926	10,533.3	783.9	7.4			11,317.2
1927	8,413.5	1,376.6	16.4			9,790.1
1928	8,532.2	2,088.8	24.5			10,621.0
1929	7,267.4	2,069.7	28.5			9,337.1
1930	6,675.4	1,988.0	29.8	18.8	0.3	8,682.2
1931	7,938.8	3,082.5	38.8	12.0	.2	11,033.3
1932	11,036.9	4,925.1	44.6	35.2	.3	15,997.2
1933	8,503.3	4,700.5	55.3	51.5	.6	13,255.3

Detailed information in regard to stage-construction work completed, in progress, and approved will be found in tables 13 to 16 and 22 to 25. The mileage classified as graded and drained consists mainly of partial relocations of previously improved roads on which surfacing has not yet been added. Such relocations are in nearly all instances needed to reduce curvature permitted in the original improvements.

The effect of stage construction as a means of raising the standard of improvement of the system will be seen by comparing tables 18 and 26, the former showing the mileage of the several types of construction completed as initial improvements during the past year and the latter the net change in the character of the total improved mileage as influenced by stage construction. Whereas, in the initial improvements completed surface construction of bituminous macadam and higher types constituted only 42 percent of the total road mileage. exclusive of

bridges and their approaches, the same high types constituted nearly 64 percent of the net increase in improved mileage. It will also be noted that the low-cost bituminous mixed surfaces and surface-treated macadam and gravel, which are intermediate types and which constituted 37 percent of the net increase, made up less than 10 percent of the mileage initially improved during the year. On the other hand, graded and drained roads and low-type untreated surfaced roads, which made up almost half of the year's initially improved mileage, appear in the table of net changes as an aggregate negative quantity, i.e., the mileage of these low types at the close of the year, in consequence of supplementary stage improvements, was less than at the end of the preceding year.

RECONSTRUCTION

During the year 51.5 miles of road previously improved with Federal aid were reconstructed and final payment of the Federal share of the cost made. As the year closed there were 15.9 miles additional in course of reconstruction. The work just completed brings the total of mileage reconstructed with Federal assistance to 117.5 miles, about 0.1 percent of the total mileage built with Federal aid.

Of the total mileage thus far rebuilt with Federal aid 45.2 miles was originally of gravel surface construction. In the reconstruction 37.6 miles of these roads have been surfaced with concrete, and 7.5 miles have been improved with bituminous concrete pavements. The remaining tenth of a mile was involved in the reconstruction of a bridge and its approaches.

Of 22.7 miles, originally of bituminous-macadam surface construction, 20.1 miles have been resurfaced with concrete and 2.6 miles with bituminous concrete. Of the rebuilt sections of bituminous concrete, totaling 16.3 miles, 2.6 miles were newly surfaced with bituminous macadam and 13.7 miles with concrete; and of the 28.7 miles originally paved with concrete, 5.8 miles have been rebuilt of the same material and 22.9 miles have been topped with bituminous concrete, the old concrete being used as a base. The single project originally paved with brick on which reconstruction has been necessary is 4.6 miles in length, and the reconstruction substituted a concrete pavement for the original surface.

Full information relative to reconstruction on Federal-aid projects will be found in tables 4 to 8 and 13 to 16.

TABLE 4.—*Federal-aid projects on which reconstruction had been completed and paid during fiscal year 1933*

State	Total cost	Federal aid	Miles
Michigan	$518,260.71	$235,352.17	19.8
Nevada	362,399.44	319,009.34	13.7
Ohio	161,397.10	68,976.64	4.6
Oklahoma	296,061.07	138,515.37	11.2
Rhode Island	63,881.28	31,940.64	2.2
Total	1,401,999.60	793,794.16	51.5

TABLE 5.—*Federal-aid projects on which reconstruction was in progress on June 30, 1933*

State	Estimated total cost	Federal aid allotted	Emergency construction funds allotted	Miles
Rhode Island	$144,716.30	$30,000.00	$114,716.30	4.3
Tennessee	322,251.95	161,125.97	161,125.98	11.6
Total	466,968.25	191,125.97	275,842.28	15.9

TABLE 6.—*Federal-aid projects, by types of construction, on which reconstruction had been completed, June 30, 1933*

State	Old construction		New construction	
	Age (years)	Type	Type	Miles
Louisiana	4	Gravel, untreated	Bituminous concrete	7.5
Maine	7	Bituminous macadam	Concrete	1.9
	9	do	do	1.6
Maryland	10	do	do	3.6
	11	do	do	3.0
	13	do	Bituminous concrete	2.6
	12	do	Concrete	3.2
	13	Portland cement concrete	do	5.8
	12	Bituminous macadam	do	1.8
Massachusetts	10	Bituminous concrete	Bituminous macadam	2.6
	8	Bituminous macadam	Concrete	2.8
Michigan	12	Bituminous concrete	do	10.0
	7	Gravel, untreated	do	4.8
	8	do	do	15.0
Nevada	13	Portland cement concrete	Bituminous concrete	9.2
	11	do	do	10.2
	10	do	do	3.5
New Hampshire	12	Bituminous concrete	Concrete	1.7
	10	do	do	2.0
Ohio	13	Brick	do	4.6
Oklahoma	11	Gravel, untreated	do	2.5
	9	do	do	2.7
	12	do	do	11.2
	9	do	Bridge	.1
Rhode Island	12	Bituminous macadam	Concrete	2.2
Vermont	5	Gravel, untreated	do	1.4

TABLE 7.—*Federal-aid projects, by types of construction, on which reconstruction had been completed and paid for during the fiscal year 1933*

State	Old construction		New construction	
	Age (years)	Type	Type	Miles
Michigan	8	Gravel, untreated	Concrete	15.0
	7	do	do	4.8
Nevada	11	Portland cement concrete	Bituminous concrete	10.2
	10	do	do	3.5
Ohio	13	Brick	Concrete	4.6
Oklahoma	12	Gravel, untreated	do	11.2
Rhode Island	12	Bituminous macadam	do	2.2

TABLE 8.—*Federal-aid projects, by types of construction, on which reconstruction was in progress, June 30, 1933*

State	Old construction		New construction	
	Age (years)	Type	Type	Miles
Rhode Island	11	Bituminous concrete	Concrete	4.3
Tennessee	13	Bituminous macadam	Graded and drained	11.2
	13	do	Bridge	.4

CHANGES IN THE FEDERAL-AID HIGHWAY SYSTEM

In the last annual report the mileage of the Federal-aid system within the boundaries of national forests, Indian reservations, and other Federal reservations was reported as 5,785 miles, as determined up to the close of the fiscal year 1932. During the past year this mileage has been increased to 6,224 miles by the addition to the system of new routes, portions of which lie within the various kinds of reservations. The location, by States, of the mileage within Federal reservations is shown in table 9.

By amendment of the Federal Highway Act, approved May 21, 1928, the original 7-percent system may be increased by these mileages within Federal reservations, and such addition, together with an increase in the mileage of the system in Hawaii authorized by a special act approved February 23, 1931, raises the permissible mileage of the initial system to 207,105 miles.

TABLE 9.—*Mileage of Federal-aid highway system within Federal reservations, being the amounts by which the 7-percent limiting mileage may be exceeded in each State as of June 30, 1933*

State	Mileage within Federal reservations	State	Mileage within Federal reservations	State	Mileage within Federal reservations
Arizona	547	Minnesota	75	Pennsylvania	108
Arkansas	120	Mississippi	10	South Dakota	475
California	465	Montana	1,053	Tennessee	66
Colorado	438	Nebraska	21	Utah	69
Georgia	58	Nevada	22	Virginia	49
Idaho	558	New Hampshire	33	Washington	440
Illinois	5	New Mexico	368	West Virginia	29
Iowa	2	New York	16	Wisconsin	46
Kansas	15	North Carolina	176	Wyoming	326
Kentucky	6	North Dakota	23		
Maine	5	Oklahoma	48	Total	6,224
Michigan	57	Oregon	495		

By section 6 of the Federal Highway Act, the State highway departments were authorized, with the approval of the Secretary of Agriculture, to add to the mileage of the original 7-percent system when provision had been made for completion and maintenance of the entire original system and funds became available for the construction and maintenance of such additional mileage. This provision was amended by section 304 of the Emergency Relief and Construction Act of 1932. Under the amended legislation the State highway departments are authorized, with the approval of the Secretary of Agriculture, to increase the original 7-percent mileage of the Federal-aid system by addition of not more than 1 percent of the total mileage of their respective States when provision has been made for the completion and maintenance of 90 percent of the original 7-percent system, and thereafter to make like increases in the mileage when provision has been made for the completion and maintenance of 90 percent of the mileage previously authorized.

Under the original provision extensions of the Federal-aid system beyond the original 7-percent limit had been made in Connecticut, Delaware, Maryland, Massachusetts, New Jersey, New York, and Rhode Island, the total of such extensions amounting at the close of the fiscal year 1932 to 3,335 miles. Under the new provision the system has been further extended in these States and additions have also been made in Florida, Illinois, Nevada, North Carolina, Oregon, and Pennsylvania. The total permissible extensions in the 13 States amounted at the close of the year 1933 to 9,511 miles.

The mileage of the actually designated Federal-aid system in each State, including the authorized extensions in 13 States and the mileage within Federal reservations, is given in table 12 which also shows the distribution by States of the 107,868.8 miles classified as completed on June 30, 1933.

The mileage classified as completed with Federal aid still includes a small mileage improved before 1921 and not since included in the designated Federal-aid system. These roads, if found not sufficiently important to be added to the system, are being gradually dropped and the Federal money invested in them transferred as a credit to the improvement of other roads in the system. A year

ago it was reported that the Federal-aid money originally paid for the improvement of 1,311 miles of such roads outside the system had been transferred to other roads within the system. Continuation of this procedure during the past year has returned to the Government the amount originally expended on other roads outside the system totalling 215.6 miles, and this money has been allotted to the initial or stage construction of other roads within the system.

The mileage of the Federal-aid system has also been reduced this year by reductions in the length of previously improved roads effected by relocations in the course of stage construction. The total of such reductions during the year was 39 miles.

CONSTRUCTION OF ROADS THROUGH PUBLIC LANDS AND FEDERAL RESERVATIONS

The Emergency Relief and Construction Act of 1932, appropriated an additional $2,000,000 to be expended for the survey, construction, reconstruction, and maintenance of main roads through unappropriated or unreserved public lands, nontaxable Indian lands, or other Federal reservations except national forests.

After deduction of the 2½-percent administrative allowance, the balance, amounting to $1,950,000, was apportioned among 14 States having more than 5 percent of their area in lands of the kind described. The apportionment was made in proportion to the area of such lands in the several States, as required by law.

As stated in the last annual report a previous appropriation of $3,000,000 made by the Emergency Employment Act of December 20, 1930, was apportioned, after deduction of the administrative percentage, among 13 States. In this earlier appropriation North Dakota did not share.

The total of the two apportionments thus far made for this purpose is $4,875,000, which amount has been apportioned among the several eligible States as shown in table 10. The same table also shows the progress made toward expenditure of the funds in the several States.

TABLE 10.—*Status of appropriations for roads through public lands and Federal reservations, June 30, 1933*

State	Total sum apportioned	Sums allotted to projects					Unobligated balance
		Not yet under construction	Under construction	Completed and finally inspected	Completed and final payment made	Total allotted	
Arizona	$708,169		$204,819.58		$416,328.00	$621,147.58	$87,021.42
California	416,153	$416,153.00				416,153.00	
Colorado	199,130		130,197.00			130,197.00	68,933.00
Idaho	277,896	34,852.78	64,441.37	$101,200.93	73,115.07	273,610.15	4,285.85
Montana	267,181		38,148.54		163,248.25	201,396.79	65,784.21
Nevada	1,029,597		410,299.49	140,933.98	357,097.99	908,331.46	121,265.54
New Mexico	411,309		102,776.11	137,934.17	170,598.72	411,309.00	
North Dakota	24,858		24,858.00			24,858.00	
Oklahoma	59,216		30,435.23		11,028.77	41,464.00	17,752.00
Oregon	324,082	10,000.00	92,953.90	204,876.46	10,400.00	318,230.36	5,851.64
South Dakota	103,034		65,715.00			65,715.00	37,319.00
Utah	543,796	92,713.00	124,400.00		326,683.00	543,796.00	
Washington	80,429		25,264.00		55,165.00	80,429.00	
Wyoming	430,150		79,598.00		344,586.23	424,184.23	5,965.77
Total	4,875,000	553,718.78	1,393,906.22	584,945.54	1,928,251.03	4,460,821.57	414,178.43

FEDERAL-AID FUNDS APPORTIONED, OBLIGATED, AND EXPENDED

The appropriation authorized for the fiscal year 1933 was $125,000,000. From this amount, however, it was necessary to deduct a portion of the amount advanced to the States of the emergency appropriation of $80,000,000 for work performed before September 1, 1931, as provided by the act approved December 20, 1930. The act required that the sums advanced of the emergency appropriation should be reimbursed to the Federal Government over a period of 5 years, commencing with the fiscal year 1933, by making deductions from the regular Federal-aid apportionments.

In the early fall of 1931 when it was desired to apportion the appropriation authorized for 1933 the amount of the $80,000,000 appropriation actually advanced was not known with certainty, since in many cases final vouchers for work done prior to September 1 had not been received. Accordingly, in the apportionment made October 15, 1931, the total authorized appropriation was reduced first by the 2½ percent allowed for administration and then by one fifth of the entire emergency appropriation, or $16,000,000, leaving a balance of $105,875,000 which was apportioned.

Subsequently, when the amounts of the emergency funds actually paid to the States became known, it was found that Alabama, California, Louisiana, Missouri, Nevada, Oregon, Texas, and Utah had not availed themselves of a part of the money allotted to them. Consequently, the apportionment of the 1933 Federal-aid funds was revised, and a new apportionment was certified on August 22, 1932, under which each of the above-named States received slightly increased sums, and the total apportioned sum was increased to $106,034,256.14. The amounts finally credited to the several States are shown in table 27.

Of this amount a large part had already been obligated when the fiscal year opened, the States having taken advantage of the provision of law which permits obligation of the authorized appropriation immediately upon its apportionment. In consequence there was available for allotment to new projects on July 1, 1932, only $61,720,100.60.

By subsequent obligation this balance had been reduced at the end of February 1933 to $15,745,969, and shortly thereafter it was found desirable to suspend further obligation of the money pending the formulation of a complete program of public works and unemployment relief. With this program definitely provided for by the National Industrial Recovery Act, the State highway departments were authorized to resume submission of projects, and by June 30, 1933, the unobligated balance had been reduced to $15,190,331.20. As no Federal-aid appropriation has been authorized for the fiscal year 1934, this represents the total sum that, under existing legislation, will be available as Federal aid during the ensuing year.

Of the $15,190,331 balance unobligated at the end of the year more than half was credited to Alabama, Florida, Mississippi, and North Carolina. Delaware, Louisiana, Maryland, and Utah had completely obligated all funds apportioned to them, and Vermont had virtually no balance. The unobligated funds of other States ranged between these extremes, with balances of less than $100,000 in each of 18 other States.

The amount obligated during the fiscal year was $46,689,025.54. The amount actually paid to the States during the year was $101,266,331.02. By reference to table 11 it will be seen that the amount obligated during the fiscal year 1933 was little more than half of the sum obligated during the preceding year. The amount expended, $101,266,331.02, was exceeded only by the expenditures of the 2 preceding years.

TABLE 11.—*Federal-aid funds apportioned to the States, obligated to projects and paid to the States each fiscal year from 1923 to 1933, inclusive*

Fiscal year	Apportioned amount of appropriation authorized for the year	Amount of Federal-aid funds obligated during the year	Amount of Federal-aid funds paid to States during the year
1923	$48,750,000.00	$77,461,559	$69,677,241.86
1924	63,375,000.00	89,866,864	79,217,397.90
1925	73,125,000.00	87,294,396	95,749,998.11
1926	73,125,000.00	79,608,897	87,754,534.57
1927	73,125,000.00	77,453,046	81,371,013.03
1928	73,125,000.00	88,922,185	80,802,232.55
1929	73,125,000.00	70,428,896	82,097,380.38
1930	73,125,000.00	102,498,084	75,880,862.84
1931	121,875,000.00	157,952,903	133,340,910.64
1932	121,875,000.00	83,793,787	127,367,119.74
1933	[1] 106,034,256.14	46,689,026	101,266,331.02
Total	[2] 900,659,256.14	961,969,643	[2] 1,014,525,022.64
Average	81,878,114.00	87,451,786	92,229,548.00

[1] Apportionment of $121,875,000 less deduction of one fifth of the emergency advance funds paid to the States.

[2] The excess of total payments over total apportionments for these years was possible because from 1917 to 1922, inclusive, the appropriations exceeded the payments by more than an equal amount.

COST OF THE ROADS

The total cost of the 8,503.3 miles of initial construction, the 4,700.5 miles of stage construction, and the 51.5 miles of reconstruction, completed and completely paid for during the year was $234,383,376, of which the Federal Government paid as regular Federal aid $104,673,505.98, and as emergency advances $4,502,467.38. These expenditures, with the exception of the emergency-fund payments, were made over the period required to construct the roads, and additional expenditures were made during the same period for other projects under construction and not yet completed. All the emergency fund expenditure was made after approval of the Emergency Relief and Construction Act of 1932.

As previously stated, the total of Federal-aid funds disbursed during the year on all active projects was $101,266,331.02, as shown in table 27. Of this sum Texas received more than $6,000,000; New York received more than $5,000,000; Illinois, Ohio, and Pennsylvania received more than $4,000,000; and California, Indiana, Michigan, and Missouri received more than $3,000,000. With the exception of seven States—Arkansas, Connecticut, Delaware, Maryland, New Hampshire, Rhode Island, and Vermont—every State received for work done during the year Federal aid in excess of $1,000,000.

FEDERAL-AID STATISTICS

Statistical information relative to the apportionment, obligation, and disbursement of Federal aid during the fiscal year 1933, the cost of roads constructed, the estimated cost of roads under construction, and the types of roads completed and under construction, etc., is given in tables 12 to 27, inclusive.

TABLE 12.—*Mileage of the designated Federal-aid highway system in each State, and mileage improved with Federal aid to June 30, 1933*

State	Mileage of designated Federal-aid highway system	Mileage completed with Federal aid to June 30, 1933	State	Mileage of designated Federal-aid highway system	Mileage completed with Federal aid to June 30, 1933
Alabama	3,933	2,344.3	New Hampshire	988	448.0
Arizona	1,979	1,270.4	New Jersey	1,378	637.9
Arkansas	4,953	1,932.8	New Mexico	3,678	2,300.9
California	5,151	2,500.1	New York	7,936	3,516.6
Colorado	3,659	1,863.7	North Carolina	5,329	2,358.8
Connecticut	978	296.8	North Dakota	7,420	5,432.1
Delaware	744	381.1	Ohio	5,914	3,057.9
Florida	2,478	661.1	Oklahoma	6,089	2,502.2
Georgia	5,610	3,238.8	Oregon	3,800	1,630.5
Idaho	3,219	1,592.4	Pennsylvania	6,971	3,276.8
Illinois	7,394	3,110.9	Rhode Island	484	271.7
Indiana	4,935	2,109.4	South Carolina	3,327	1,962.5
Iowa	7,404	3,540.0	South Dakota	6,279	4,305.3
Kansas	7,919	4,052.9	Tennessee	3,979	1,723.5
Kentucky	3,701	1,933.6	Texas	12,797	8,113.8
Louisiana	2,742	1,619.6	Utah	1,743	1,286.3
Maine	1,588	823.0	Vermont	1,036	393.8
Maryland	2,154	872.7	Virginia	3,782	1,994.3
Massachusetts	1,494	875.9	Washington	3,177	1,330.7
Michigan	5,237	2,339.2	West Virginia	2,223	925.6
Minnesota	6,880	4,309.6	Wisconsin	5,557	2,760.1
Mississippi	3,672	1,863.8	Wyoming	3,565	2,179.8
Missouri	7,789	3,233.2	Hawaii	532	109.4
Montana	5,409	2,973.2			
Nebraska	5,594	4,259.7	Total	206,277	107,868.8
Nevada	1,677	1,352.1			

TABLE 13.—*Total cost, Federal aid, emergency-construction funds and mileage of Federal-aid roads, initial and stage construction and reconstruction completed and paid during the fiscal year 1933*

State	Total cost	Federal aid	Emergency-construction fund	Mileage			
				Initial	Stage	Reconstruction	Total
Alabama	$851,589.81	$416,627.21	$32,096.81	48.3	2.9		51.2
Arizona	2,943,249.17	1,865,813.39	151,038.19	180.2	55.9		236.1
Arkansas	1,217,496.66	547,650.99	11,943.65	42.8	13.1		55.9
California	12,588,064.71	5,053,787.44	100,204.46	259.1	61.7		320.8
Colorado	6,231,801.63	3,245,873.60	39,995.08	261.0	86.1		347.1
Connecticut	890,283.84	385,618.19		15.5			15.5
Delaware	906,164.10	445,822.00		44.7			44.7
Florida	1,631,013.70	655,259.58		46.3			46.3
Georgia	5,607,211.60	2,510,750.75	275,916.35	156.0	196.6		352.6
Idaho	3,156,383.70	1,716,286.11	105,682.63	142.3	272.6		414.9
Illinois	16,893,315.42	7,455,977.97	148,926.69	529.4	18.7		548.1
Indiana	7,427,449.90	3,569,069.33		286.9	20.3		307.2
Iowa	4,057,333.54	1,963,494.89	50,987.40	198.8	57.1		255.9
Kansas	6,640,001.36	3,131,186.23	313,460.23	350.0	504.5		854.5
Kentucky	3,606,398.13	1,549,413.51	166,979.73	198.5	78.8		277.3
Louisiana	3,012,731.39	1,222,892.52		70.6	6.1		76.7
Maine	3,520,877.34	1,596,365.81		113.4			113.4
Maryland	2,269,635.36	980,609.52	26,601.80	90.5	3.9		94.4
Massachusetts	10,932,943.73	3,512,886.73		124.5	.1		124.6
Michigan	13,018,041.46	5,167,271.46	128,676.87	407.0	65.5	19.8	492.3
Minnesota	5,317,756.46	2,050,016.98		104.4	195.3		299.7
Mississippi	1,433,803.60	697,860.59		64.0	23.9		87.9
Missouri	7,604,294.83	3,363,337.14	343,046.76	242.8	98.9		341.7
Montana	4,602,094.59	2,596,366.64	339,139.48	462.7	242.3		705.0
Nebraska	5,990,719.28	2,860,028.67	49,008.26	199.0	190.9		389.9
Nevada	1,551,054.17	1,230,613.97		25.9	152.4	13.7	192.0
New Hampshire	967,954.18	415,666.92	15,537.26	24.7	3.0		27.7
New Jersey	2,526,737.77	1,125,124.36		27.7	.6		28.3
New Mexico	3,020,227.53	1,948,908.43	85,889.00	150.0	74.5		224.5
New York	14,595,175.16	6,178,882.72	161,749.60	348.1	9.9		358.0
North Carolina	1,274,287.01	613,781.87	64,095.20	87.5	9.0		96.5
North Dakota	2,997,722.64	1,424,496.05	250,411.75	451.4	836.3		1,287.7
Ohio	14,118,390.17	4,924,980.24	143,981.17	236.3	69.0	4.6	309.9
Oklahoma	5,748,040.86	2,807,159.37		199.9	63.7	11.2	274.8
Oregon	4,618,655.83	2,482,705.69	15,612.39	163.8	110.2		274.0
Pennsylvania	8,053,881.00	3,338,317.63		214.3			214.3
Rhode Island	899,371.60	402,014.81	82,719.26	18.8		2.2	21.0
South Carolina	2,229,626.74	1,056,781.26		66.4	48.5		114.9
South Dakota	3,510,649.41	1,773,670.77	462,206.74	283.5	362.6		646.1
Tennessee	2,059,702.60	990,386.73	58,621.76	73.3	27.3		100.6
Texas	14,040,148.34	6,385,364.67	133,878.28	728.4	296.8		1,025.2
Utah	865,919.56	532,896.50	18,486.38	61.3	44.5		105.8
Vermont	1,170,553.66	537,596.26	50,266.01	52.5			52.5
Virginia	1,848,006.46	823,207.81	19,626.90	89.9	18.1		108.0
Washington	3,737,632.45	1,647,910.51	155,649.35	122.6	20.1		142.7
West Virginia	2,602,043.78	1,129,053.28		57.6	10.8		68.4
Wisconsin	6,723,170.51	2,669,740.97	365,196.40	215.1	75.0		290.1
Wyoming	2,636,836.36	1,489,510.99	134,835.54	163.5	269.4		432.9
Hawaii	236,932.90	184,466.92		2.1	3.6		5.7
Total	234,383,376.00	104,673,505.98	4,502,467.38	8,503.3	4,700.5	51.5	13,255.3

TABLE 14.—*Total cost, Federal-aid and emergency-construction funds, and mileage of Federal-aid roads, initial and stage construction completed but final payment not made, June 30, 1933* [1]

State	Estimated total cost	Federal aid allotted	Emergency-construction funds allotted	Mileage		
				Initial	Stage	Total
Alabama	$1,022,434.29	$468,949.14	$96,120.09	27.2	9.7	36.9
Arizona	1,054,277.55	613,947.45	414,926.16	32.5	83.6	116.1
Arkansas	802,239.92	395,783.20	62,732.23	16.5	13.3	29.8
California	2,143,562.50	601,583.90	1,175,618.52	23.3	15.5	38.8
Colorado	2,151,461.56	1,073,298.91	459,395.63	93.1	55.5	148.6
Connecticut	101,380.16	41,440.26	59,939.90	5.0		5.0
Delaware	200,108.25	56,668.00	112,872.25	7.0	6.0	13.0
Florida	818,923.98	407,826.68		20.4		20.4
Georgia	1,049,142.26	424,387.40	577,058.27	33.7	25.9	59.6
Idaho	283,965.69	141,776.17	66,545.27	15.0	14.5	29.5
Illinois	407,987.23	192,330.74		21.1		21.1
Indiana	2,117,990.49	1,058,995.21		106.5		106.5
Kansas	911,055.05	366,680.08	383,144.10	96.0	12.6	108.6
Kentucky	1,223,649.20	522,430.82	148,226.34	38.1	43.7	81.8
Louisiana	948,689.27	459,239.53		12.8	1.5	14.3
Maine	178,571.26	79,264.98		4.0		4.0
Maryland	651,470.10	253,713.22	137,104.80	29.0		29.0
Massachusetts	3,769,411.28	1,156,339.54		36.6		36.6
Michigan	1,935,002.26	917,200.00	145,210.00	71.4	26.3	97.7
Minnesota	5,303,803.37	1,720,347.31		106.2	116.9	223.1
Mississippi	1,022,185.17	497,015.24	92,283.94	30.1	18.2	48.3
Missouri	632,031.21	152,433.21	253,965.42	23.9	10.8	34.7
Montana	929,944.41	526,053.72	177,947.77	69.0	19.2	88.2
Nebraska	375,453.00	171,910.99		16.8	7.4	24.2
Nevada	800,236.64	510,730.49	197,203.97	25.9	50.4	76.3
New Hampshire	352,589.90	150,706.90	153,528.30	9.0	2.9	11.9
New Jersey	1,542,436.15	633,999.15		13.1	.3	13.4
New Mexico	1,936,681.20	1,053,864.55	346,467.04	119.4	42.0	161.4
New York	2,519,410.33	842,080.00	150,780.00	40.0	7.7	47.7
North Carolina	517,037.06	258,518.50	258,518.56	76.3	6.8	83.1
North Dakota	1,208,311.82	445,490.29	363,853.37	132.9	148.5	281.4
Ohio	1,061,500.00	352,454.82	162,500.00	29.5	12.5	42.0
Oklahoma	2,767,478.97	1,364,700.23	187,370.55	173.2	22.7	195.9
Oregon	919,789.06	447,573.07	68,359.76	14.4	26.6	41.0
Pennsylvania	3,888,476.78	1,871,028.43	126,500.00	81.9		81.9
South Carolina	309,789.67	147,500.00		1.6	12.0	13.6
South Dakota	502,824.50	168,281.15	251,876.15	16.5	21.4	37.9
Tennessee	893,015.81	445,802.75	334,786.94	11.8	31.7	43.5
Texas	5,583,704.60	2,452,858.80	633,717.23	210.4	145.3	355.7
Utah	1,113,743.01	647,896.53	240,196.21	43.4	88.3	131.7
Vermont	92,612.13	10,089.30	82,522.83	2.2		2.2
Virginia	2,122,902.58	1,026,341.44	332,886.52	104.0	23.8	127.8
Washington	442,269.37	227,700.00	39,346.52	17.2		17.2
West Virginia	664,908.12	282,086.17	50,900.00	19.0	.1	19.1
Wisconsin	856,685.71	264,595.00	179,100.00	17.2	11.1	28.3
Wyoming	473,977.52	111,063.11	310,605.36	46.4	32.2	78.6
Hawaii	1,055,299.79	492,189.85	198,270.76	31.1		31.1
Total	61,660,420.18	26,507,166.23	9,032,380.76	2,171.6	1,166.9	3,338.5

[1] There was no reconstruction in this status.

TABLE 15.—*Total cost, Federal-aid and emergency-construction funds of Federal-aid roads, initial and stage, and reconstruction improvement under construction, by States, June 30, 1933*

State	Estimated total cost	Federal aid allotted	Emergency-construction funds allotted	Mileage			
				Initial	Stage	Reconstruction	Total
Alabama	$5,032,976.50	$2,516,488.13	$2,429,896.53	131.2	110.3		241.5
Arizona	2,884,355.53	1,355,008.46	1,156,973.26	68.0	126.7		194.7
Arkansas	4,613,104.71	2,192,025.82	1,399,024.25	130.6	89.0		219.6
California	7,629,209.24	1,565,804.03	3,164,911.21	130.4	55.1		185.5
Colorado	2,900,175.77	1,320,286.76	1,254,035.41	116.6	19.1		135.7
Connecticut	4,110,880.78	1,695,978.21	713,043.74	43.7	5.3		49.0
Delaware	755,181.00	150,125.44	487,127.75	23.6	15.9		39.5
Florida	6,609,972.32	3,168,669.14	1,622,334.04	172.4			172.4
Georgia	4,303,700.67	1,748,672.41	2,174,794.41	107.4	180.6		288.0
Idaho	2,354,542.60	841,030.70	1,216,551.29	90.6	113.9		204.5
Illinois	20,162,768.27	7,703,139.50	4,817,411.34	617.0	60.6		677.6
Indiana	7,139,311.52	2,773,730.55	1,675,172.53	228.3	20.7		249.0
Iowa	5,321,273.39	803,331.76	3,036,095.00	261.1	38.5		299.6
Kansas	3,498,351.61	1,032,386.15	2,223,231.22	190.3	61.0		251.3
Kentucky	4,024,383.53	1,395,480.17	1,777,631.46	159.6	122.0		281.6
Louisiana	6,392,245.96	2,785,921.90	1,745,559.00	42.3	24.8		67.1
Maine	2,203,423.77	508,213.51	1,022,055.05	66.4	.3		66.7
Maryland	965,442.17	99,880.77	674,480.80	33.3	1.5		34.8
Massachusetts	4,115,901.96	972,218.48	1,716,612.00	57.2	4.9		62.1
Michigan	6,674,228.20	2,567,439.95	3,056,012.55	283.9	97.1		381.0
Minnesota	4,768,398.82	202,728.91	3,368,559.00	150.9	139.9		290.8
Mississippi	6,193,724.28	3,072,313.77	1,887,073.87	185.3	97.9		283.2
Missouri	4,351,270.58	737,807.32	2,924,482.16	173.8	17.0		190.8
Montana	5,616,576.61	3,142,856.07	1,995,179.60	405.9	255.8		661.7
Nebraska	6,234,000.11	2,913,882.72	2,475,211.63	156.3	159.9		316.2
Nevada	1,975,857.64	721,167.78	1,112,891.37	38.7	127.5		166.2
New Hampshire	563,304.16	232,591.90	292,550.93	12.5	.5		13.0
New Jersey	5,309,569.73	1,735,318.97	1,657,733.00	55.7			55.7
New Mexico	2,532,793.19	975,113.25	1,433,387.86	127.9	103.5		231.4
New York	18,271,330.05	5,611,850.00	5,746,708.40	479.1	32.0		511.1
North Carolina	5,040,679.02	2,518,674.96	2,418,532.14	513.8	28.1		541.9
North Dakota	3,495,612.32	1,451,921.71	1,134,146.39	237.3	410.3		647.6
Ohio	8,085,323.09	2,179,738.01	3,881,281.62	177.5	52.3		229.8
Oklahoma	3,951,579.57	1,210,698.90	1,941,473.65	191.3	74.7		266.0
Oregon	4,104,798.63	1,640,267.03	1,893,331.83	106.6	74.4		181.0
Pennsylvania	10,077,698.86	2,532,150.15	5,117,760.00	348.7	14.0		362.7
Rhode Island	1,013,905.12	318,007.01	517,280.74	22.5	.2	4.3	27.0
South Carolina	3,413,612.84	1,277,642.73	1,652,684.92	161.2	154.7		315.9
South Dakota	3,155,035.66	1,288,695.86	1,153,545.62	249.4	201.7		451.1
Tennessee	4,645,392.30	2,321,975.19	2,166,751.30	159.6	29.2	11.6	200.4
Texas	15,549,620.20	5,086,325.25	6,626,962.65	551.2	502.8		1,054.0
Utah	1,877,602.57	774,640.08	981,628.10	127.8	36.3		164.1
Vermont	366,965.01	43,473.80	313,523.12	18.6			18.6
Virginia	4,026,229.27	1,817,348.27	1,651,770.84	179.6	52.7		232.3
Washington	3,045,261.29	916,420.63	1,607,716.37	109.6	9.7		119.3
West Virginia	3,071,207.15	1,256,848.11	1,229,084.72	113.8	8.1		121.9
Wisconsin	5,384,047.69	966,926.70	2,445,526.64	136.3	101.9		238.2
Wyoming	2,606,875.23	859,481.92	1,086,437.37	215.7	137.9		353.6
Hawaii	1,687,095.81	1,138,158.71	401,236.93	36.9			36.9
Total	242,106,796.30	86,140,857.55	98,477,405.61	8,397.4	3,970.3	15.9	12,383.6

TABLE 16.—*Total cost, Federal-aid and emergency-construction funds, and mileage of Federal-aid roads, initial and stage improvement, approved for construction, by States, June 30, 1933* [1]

State	Estimated total cost	Federal aid allotted	Emergency-construction funds allotted	Mileage		
				Initial	Stage	Total
Arizona	$43,050.08	$27,982.56	$15,067.52	-------	5.9	5.9
Arkansas	1,187,545.23	593,772.55	573,258.96	102.1	15.7	117.8
California	73,760.41	17,153.65	35,509.29	.9	2.0	2.9
Colorado	394,215.58	177,396.98	216,818.60	27.9	.2	28.1
Idaho	81,908.25	41,788.31	15,524.69	6.2	3.4	9.6
Illinois	716,775.42	311,902.26	106,925.46	27.0	-------	27.0
Indiana	1,372,003.25	133,528.13	1,130,860.02	65.0	5.3	70.3
Kansas	163,196.62	75,935.47	77,101.92	8.6	3.1	11.7
Kentucky	283,561.74	126,218.05	126,218.06	10.7	13.9	24.6
Maine	38,958.62	3,989.09	15,956.35	-------	1.9	1.9
Maryland	251,758.25	25,648.82	181,382.60	5.4	-------	5.4
Michigan	602,750.00	196,440.00	360,360.00	39.3	.8	40.1
Mississippi	250,653.30	125,326.62	125,326.68	11.6	4.2	15.8
Missouri	445,829.85	91,623.60	227,500.00	13.1	16.6	29.7
Montana	57,325.91	32,350.96	9,963.38	-------	12.0	12.0
New Hampshire	85,798.47	36,415.44	49,383.03	1.6	.7	2.3
New Mexico	111,736.03	44,694.41	61,454.82	-------	5.1	5.1
North Carolina	324,785.47	162,392.71	147,105.10	43.4	.3	43.7
North Dakota	299,625.98	123,677.17	61,302.75	22.8	73.5	96.3
Ohio	76,364.00	23,361.08	48,000.00	1.3	3.3	4.6
Oklahoma	528,539.65	105,707.88	422,831.77	38.2	-------	38.2
Oregon	59,172.74	26,004.62	24,189.48	1.7	1.6	3.3
South Dakota	278,850.45	120,075.71	135,595.30	20.3	29.1	49.4
Texas	719,256.12	250,336.03	244,627.86	40.8	18.3	59.1
Utah	259,868.69	111,261.16	146,207.53	24.7	12.4	37.1
Vermont	201,364.63	43,000.00	153,488.04	7.6	6.5	14.1
Virginia	35,537.10	17,768.54	17,768.55	2.3	-------	2.3
Wisconsin	52,061.50	21,500.00	-------	-------	.9	.9
Total	8,996,253.34	3,067,251.80	4,729,727.76	522.5	236.7	759.2

[1] There was no reconstruction in this status.

TABLE 17.—*Mileage of Federal-aid roads, improved, by types of construction, by States, June 30, 1933*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							
Alabama	212.0	507.3		882.6	4.4		14.7		62.8	135.0	512.8		12.7	2,344.3
Arizona	6.9	31.0		340.1				731.7	.9	38.9	110.6		10.3	1,270.4
Arkansas	91.2			882.1		41.1	86.2			266.0	547.1		19.1	1,932.8
California	403.0			453.3		26.8		427.9	110.1	306.6	755.4		17.0	2,500.1
Colorado	177.8	47.4		790.1		88.6		300.2		14.3	418.8		26.5	1,863.7
Connecticut	2.0			3.3		17.2	5.4		42.7	.6	219.8		5.8	296.8
Delaware	1.7			30.4				11.7		5.5	324.1	6.2	1.5	381.1
Florida	4.4	15.5			1.0	85.4	122.1		72.5	79.1	260.6	10.2	10.3	661.1
Georgia	275.1	783.6		397.1	3.7	52.3	331.9	32.9	225.0	118.0	988.0	3.0	28.2	3,238.8
Idaho	166.8			603.6		158.3		494.9	20.3	92.2	49.8		6.5	1,592.4
Illinois	146.7			.4					3.4	3.2	2,919.0	31.6	6.6	3,110.9
Indiana	5.8			90.2					17.0	12.0	1,970.1	6.6	7.7	2,109.4
Iowa	1,106.2			453.9							1,955.4	22.0	2.5	3,540.0
Kansas	1,141.8	645.1		337.9	115.1			472.6	129.6	10.7	1,012.2	163.2	24.7	4,052.9
Kentucky	513.3			445.9		16.2	50.3	38.1	84.3	207.8	566.7	3.9	7.1	1,933.6
Louisiana	59.9			1,284.4					3.2	41.8	214.4		15.9	1,619.6
Maine				238.3	163.6				230.6		187.0		3.5	823.0
Maryland	4.9			38.9		.1	3.9		270.1	55.5	498.5		.8	872.7
Massachusetts				.4	.4	.2	2.7	18.7	481.2	76.5	285.1		10.7	875.9
Michigan	92.6			351.3			16.3		5.4	96.4	1,770.4	.4	6.4	2,339.2
Minnesota	1,061.4	11.1		1,486.7	17.7					32.7	1,697.0		3.0	4,309.6
Mississippi	328.9	15.8		1,141.7		11.1				12.5	329.0	9.5	15.3	1,863.8
Missouri	402.4			764.0		19.6			27.4	7.2	1,989.4	7.5	15.7	3,233.2
Montana	266.3			2,176.3				467.6		13.1	37.4		12.5	2,973.2
Nebraska	365.6	3,261.5	6.6					103.4		14.6	477.4	19.4	11.2	4,259.7
Nevada	31.8			432.0	10.2			829.2	5.8	24.8	16.5		1.8	1,352.1
New Hampshire					.3	91.6	87.4		90.4	31.9	141.1		5.3	448.0
New Jersey	11.6			6.1			.2		.7	22.5	592.2		4.6	637.9
New Mexico	246.7	19.1		1,578.5				353.4		.7	91.7		10.8	2,300.9
New York	63.1			90.0					461.2	115.4	2,784.0	.7	2.2	3,516.6
North Carolina	81.0	461.9	44.1	126.9	46.2	32.8	8.9	140.7	35.3	302.5	1,070.2		8.3	2,358.8
North Dakota	630.3	.3		4,513.9	129.1			121.7		1.2	26.1		9.5	5,432.1
Ohio	126.8			51.1		107.7	26.1		373.3	140.3	1,528.4	679.1	25.1	3,057.9
Oklahoma	605.3	.6		519.1	8.3	28.8			.6	151.0	1,161.1	8.9	18.5	2,502.2
Oregon	311.5			773.9	30.4	42.9	50.9	16.3	245.0	43.7	106.1		9.8	1,630.5
Pennsylvania	171.0					476.6	10.6		7.8	93.9	2,466.7	43.4	6.8	3,276.8
Rhode Island	5.8						1.8		94.4	45.9	120.7		3.1	271.7
South Carolina	52.8	876.4		101.0					.3	185.0	722.8		24.2	1,962.5
South Dakota	147.1	20.2	15.7	3,790.9	46.1			113.9		4.9	159.3		7.2	4,305.3
Tennessee	165.5			106.2		61.5			341.8	232.7	805.3		10.5	1,723.5
Texas	940.0	15.2		2,554.0	505.9	69.0	260.7	10.7	519.9	821.5	2,329.4	30.2	57.3	8,113.8

Utah	94.0			350.3	7.4	260.1		431.6	.8	14.4	123.3		4.4	1,286.3
Vermont				117.6	2.0	1.1		16.1	61.2		188.5		7.3	393.8
Virginia	184.0	372.6	13.7	108.9	5.2	317.9	41.5		386.8	48.5	503.3		11.9	1,994.3
Wasnington	239.9			600.8							483.0		7.0	1,330.7
West Virginia	258.9			30.5		19.5	1.7	1.4	200.1	28.1	371.6	10.3	3.5	925.6
Wisconsin	172.7	19.0		866.6	15.8				13.8	.5	1,660.7		11.0	2,760.1
Wyoming	400.1	7.1		1,205.8				515.3	1.7	22.1	17.4		10.3	2,179.8
Hawaii									75.8	13.3	19.0		1.3	109.4
Total	11,776.6	7,110.7	80.1	31,117.0	1,112.8	2,026.4	1,123.3	5,650.0	4,703.2	3,985.0	37,584.4	1,056.1	543.2	107,868.8

15927—33—3

TABLE 18.—*Mileage of Federal-aid roads, by types of construction, by States, initially completed and paid for during fiscal year 1933*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							
Alabama	47.9												0.4	48.3
Arizona	5.3			75.2				97.8					1.9	180.2
Arkansas	22.5			4.2							15.8		.3	42.8
California	21.5			21.6				98.8		42.9	70.6		3.7	259.1
Colorado	.4			174.7				69.5			14.1		2.3	261.0
Connecticut	2.0						5.3				7.6		.6	15.5
Delaware				10.2							33.9		.6	44.7
Florida							2.9			4.1	39.1		.2	46.3
Georgia	67.1	6.4		22.1			10.6	.9			48.4		.5	156.0
Idaho				54.8				87.2					.3	142.3
Illinois	43.6										481.1		4.7	529.4
Indiana	18.5										266.3		2.1	286.9
Iowa	60.9			26.0							111.6		.3	198.8
Kansas	191.2	.9		28.0				80.8			46.2		2.9	350.0
Kentucky	120.5			25.9		1.0					50.4		.7	198.5
Louisiana	19.9			1.2							48.8		.7	70.6
Maine				3.2	47.3				39.1		22.6		1.2	113.4
Maryland									29.1	16.1	45.2		.1	90.5
Massachusetts									63.8	7.4	48.4		4.9	124.5
Michigan	125.5			29.9						12.1	238.5		1.0	407.0
Minnesota	43.2										61.2			104.4
Mississippi	41.1										22.4		.5	64.0
Missouri	17.8			48.0							175.8		1.2	242.8
Montana	187.2			214.7				59.3					1.5	462.7
Nebraska	7.0	132.3						26.5			31.3	.1	1.8	199.0
Nevada				25.9										25.9
New Hampshire							2.9		3.6		17.7		.5	24.7
New Jersey									.1		27.0		.6	27.7
New Mexico	11.1			116.2				14.9			5.4		2.4	150.0
New York	17.5			15.3					24.2	34.5	256.5		.1	348.1
North Carolina		16.8	22.6	20.7	6.7			10.1		2.2	7.8		.6	87.5
North Dakota	346.5			103.3				1.1					.5	451.4
Ohio	6.1			14.9					10.8	13.8	131.4	48.0	11.3	236.3
Oklahoma	61.1										137.8		1.0	199.9
Oregon	17.6			23.5	7.2	7.3	38.8	4.9	62.4	.9			1.2	163.8
Pennsylvania	.9					132.3					78.7	1.1	1.3	214.3
Rhode Island	5.8								3.8	1.3	7.4		.5	18.8
South Carolina											66.3		.1	66.4
South Dakota	45.1			235.8							2.3		.3	283.5
Tennessee	12.4									26.3	34.1		.5	73.3
Texas	496.6			6.8	49.9		11.0		8.1	.1	147.5		8.4	728.4

Utah				51.2				8.7		.6	.6		.2	61.3
Vermont				7.4				16.1	3.1		25.5		.4	52.5
Virginia	10.2	46.1				23.1			7.3		2.8		.4	89.9
Washington	22.6			60.8							38.6		.6	122.6
West Virginia	18.0										38.9		.7	57.6
Wisconsin	44.9			17.2							152.4		.6	215.1
Wyoming	41.5			79.6				41.4					1.0	163.5
Hawaii									1.5				.6	2.1
Total	2,201.0	202.5	22.6	1,518.3	111.1	163.7	71.5	618.0	256.9	162.3	3,058.0	49.2	68.2	8,503.3

TABLE 19.—*Mileage of Federal-aid roads, by types of construction, by States, initial construction completed but final payment not made, June 30, 1933*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							
Alabama	26.0										0.8		0.4	27.2
Arizona				25.8				5.0			1.7			32.5
Arkansas	6.1										10.1		.3	16.5
California	11.3			1.6				3.6			3.0		3.8	23.3
Colorado				64.9				25.2					3.0	93.1
Connecticut				3.1							1.9			5.0
Delaware	1.7									0.2	5.1			7.0
Florida							9.6				9.7		1.1	20.4
Georgia	10.2						6.2				17.3			33.7
Idaho				12.3				2.5					.2	15.0
Illinois	13.4										7.2		.5	21.1
Indiana											106.5			106.5
Iowa														
Kansas	86.3	8.0									.9		.8	96.0
Kentucky	13.8										24.1		.2	38.1
Louisiana											12.2		.6	12.8
Maine									3.9				.1	4.0
Maryland									21.1		7.8		.1	29.0
Massachusetts									10.3		25.4		.9	36.6
Michigan	17.3			10.5						1.5	41.9		.2	71.4
Minnesota	45.5										60.7			106.2
Mississippi	21.5										7.6		1.0	30.1
Missouri	3.7			17.4							2.7		.1	23.9
Montana	23.0			45.7									.3	69.0
Nebraska		16.8												16.8
Nevada				1.1				24.8						25.9
New Hampshire											9.0			9.0
New Jersey											12.8		.3	13.1
New Mexico				67.9				50.8					.7	119.4
New York	9.1									.1	30.7		.1	40.0
North Carolina		8.8	17.5		19.1	7.0	9.0			14.3	.2		.4	76.3
North Dakota	96.2			36.5									.2	132.9
Ohio										6.6	18.8	3.8	.3	29.5
Oklahoma	130.2										41.6		1.4	173.2
Oregon	3.3			2.6			8.1				.3		.1	14.4
Pennsylvania	2.4					40.6				.5	37.4		1.0	81.9
Rhode Island														
South Carolina											1.6			1.6
South Dakota				16.4									.1	16.5
Tennessee	7.2										4.6			11.8

Texas	109.7			8.1	33.6		32.3			.2	23.5	3.0	210.4
Utah				22.1				14.0			6.9	.4	43.4
Vermont				2.1								.1	2.2
Virginia	32.4	27.3				40.9					2.8	.6	104.0
Washington				17.1								.1	17.2
West Virginia											19.0		19.0
Wisconsin				6.8							10.2	.2	17.2
Wyoming	19.6			26.5								.3	46.4
Hawaii									31.0			.1	31.1
Total	689.9	60.9	17.5	388.5	52.7	88.5	65.2	125.9	66.3	23.4	566.0	3.8	23.0	2,171.6

TABLE 20.—*Mileage of Federal-aid roads, by types of construction, by States, under initial construction, June 30, 1933*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							
Alabama	45.2							14.2		14.5	55.8		1.5	131.2
Arizona	22.2			24.9				20.3					.6	68.0
Arkansas	3.0			3.7	19.4			27.8			75.9		.8	130.6
California	17.9				6.3			50.8		21.5	32.3		1.6	130.4
Colorado	6.8			76.8				13.9		13.4	2.7		3.0	116.6
Connecticut				5.5					6.9	.2	27.1		4.0	43.7
Delaware											23.6			23.6
Florida	85.0						34.3			5.2	42.2		5.7	172.4
Georgia	55.7		0.2		11.7		22.0	.3		6.0	10.6		.9	107.4
Idaho				80.0				10.2					.4	90.6
Illinois	30.2										580.7		6.1	617.0
Indiana	27.3										196.4		4.6	228.3
Iowa	69.5			56.2							134.2		1.2	261.1
Kansas	172.2			7.0							9.2		1.9	190.3
Kentucky	116.6			10.5							31.0		1.5	159.6
Louisiana	8.4			2.1							28.9		2.9	42.3
Maine					27.8				8.3		29.5		.8	66.4
Maryland	4.3			6.1					6.9	4.6	11.2		.2	33.3
Massachusetts								3.5	22.1	11.4	18.5		1.7	57.2
Michigan	84.3			53.0				5.8		13.3	126.6		.9	283.9
Minnesota	108.5										42.4			150.9
Mississippi	88.8		9.3	4.2						8.7	71.7		2.6	185.3
Missouri	26.6			75.1							70.3		1.8	173.8
Montana	112.1			259.6				32.4					1.8	405.9
Nebraska	75.6	26.7						39.5			12.0		2.5	156.3
Nevada	8.0			19.3				10.3			1.1			38.7
New Hampshire					1.5		6.6		1.3		2.7		.4	12.5
New Jersey	12.7								.2		41.5		1.3	55.7
New Mexico	43.7			75.9	6.8						.2		1.3	127.9
New York	52.2			68.6	6.2				34.7	37.0	277.7	1.1	1.6	479.1
North Carolina	72.4	127.1	51.7	100.9	55.1	31.5		73.1					2.0	513.8
North Dakota	218.7			17.6				.4					.6	237.3
Ohio	9.0			1.0			1.2			38.6	88.6	35.6	3.5	177.5
Oklahoma	162.0										27.5		1.8	191.3
Oregon	51.6			18.1					28.1	.1	7.3		1.4	106.6
Pennsylvania	24.1					142.1	14.5			39.6	127.1		1.3	348.7
Rhode Island									11.9	3.4	7.1		.1	22.5
South Carolina		18.0	85.4		20.2						37.1		.5	161.2
South Dakota	135.5			112.7				.9					.3	249.4
Tennessee	63.3									37.8	55.5		3.0	159.6
Texas	277.4			48.0	72.6		12.2		6.0	5.8	121.7	3.1	4.4	551.2

Utah				94.8				28.3		1.5	2.4		.8	127.8
Vermont				18.3				.1			.1		.1	18.6
Virginia	32.3	79.9		1.0		59.4				.3	6.1		.6	179.6
Washington	17.1			91.7									.8	109.6
West Virginia	82.7			3.1			21.0				6.6		.4	113.8
Wisconsin	36.6			11.7							87.1		.9	136.3
Wyoming	157.1			17.7				40.0					.9	215.7
Hawaii									36.6				.3	36.9
Total	2,616.6	251.7	146.6	1,365.1	227.6	233.0	111.8	371.8	163.0	262.9	2,530.2	39.8	77.3	8,397.4

TABLE 21.—*Mileage of Federal-aid roads, by types of construction, by States, approved for initial construction, on June 30, 1933*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							
Arkansas	12.7				11.1		15.0	63.2					0.1	102.1
California											0.9			.9
Colorado				27.9										27.9
Idaho				6.2										6.2
Illinois											26.9		.1	27.0
Indiana	17.3										47.7			65.0
Kansas	1.8	3.0		1.2							2.5		.1	8.6
Kentucky	6.7										4.0			10.7
Maryland											5.3		.1	5.4
Michigan	4.0	6.5		3.7						10.7	13.9	0.5		39.3
Mississippi	11.1										.2		.3	11.6
Missouri											13.1			13.1
New Hampshire							1.6							1.6
North Carolina		13.3			.2	17.4		12.0			.5			43.4
North Dakota	22.6			.2										22.8
Ohio										1.1	.2			1.3
Oklahoma	34.7										3.0		.5	38.2
Oregon										1.4	.3			1.7
South Dakota	20.3													20.3
Texas	21.3			18.9									.6	40.8
Utah				17.1				5.0		1.9	.7			24.7
Vermont								7.4					.2	7.6
Virginia	2.3													2.3
Total	154.8	22.8		75.2	11.3	17.4	16.6	87.6		15.1	119.2	.5	2.0	522.5

TABLE 22.—*Mileage of Federal-aid road stage construction, by types of construction, by States, completed and paid for during fiscal year 1933*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							
Alabama											2.9			2.9
Arizona	0.5			19.4				32.5		3.1			0.4	55.9
Arkansas				1.3							11.7		.1	13.1
California				.4				20.4		4.1	35.1		1.7	61.7
Colorado				.3				50.1			35.3		.4	86.1
Georgia	38.1			12.2			46.3				99.3		.7	196.6
Idaho				8.8				260.3		3.3			.2	272.6
Illinois											18.7			18.7
Indiana											19.3		1.0	20.3
Iowa	.9										56.2			57.1
Kansas	3.1	127.9		18.5				323.1		7.7	23.2		1.0	504.5
Kentucky				22.4						5.4	50.9		.1	78.8
Louisiana											6.1			6.1
Maryland										2.3	1.6			3.9
Massachusetts													.1	.1
Michigan	7.3									8.0	49.8		.4	65.5
Minnesota	44.9										150.3		.1	195.3
Mississippi	15.1										8.4		.4	23.9
Missouri				3.5							95.3		.1	98.9
Montana				110.3				132.0						242.3
Nebraska		14.8						51.6			123.6		.9	190.9
Nevada				.8				151.2					.4	152.4
New Hampshire											3.0			3.0
New Jersey													.6	.6
New Mexico				9.8				63.8					.9	74.5
New York										6.9	3.0			9.9
North Carolina			4.0					5.0						9.0
North Dakota	26.4			740.5				69.1		.1			.2	836.3
Ohio				.2					0.9	.4	44.6	21.2	1.7	69.0
Oklahoma											63.7			63.7
Oregon				49.3			3.4		48.1	6.2	3.2			110.2
South Carolina	14.9										33.6			48.5
South Dakota	70.2			145.2	38.5			62.6		4.9	40.8		.4	362.6
Tennessee										6.4	20.9			27.3
Texas	15.9			2.8	54.2		40.5			9.2	173.1		1.1	296.8
Utah				2.1				41.7			.5		.2	44.5
Virginia		7.9				5.1	4.0				1.1			18.1
Washington	.1			1.6							18.4			20.1
West Virginia	6.1										4.7			10.8
Wisconsin	2.1										72.6		.3	75.0
Wyoming	2.3			172.9				93.8					.4	269.4
Hawaii									3.6					3.6
Total	247.9	150.6	4.0	1,322.3	92.7	5.1	94.2	1,357.2	52.6	68.0	1,270.9	21.2	13.8	4,700.5

TABLE 23.—*Mileage of Federal-aid roads, by types of construction, by States, stage construction, completed but final payment not made, June 30, 1933*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							
Alabama											9.7			9.7
Arizona								82.8					0.8	83.6
Arkansas											13.3			13.3
California											15.2		.3	15.5
Colorado	0.7			3.4				40.3			10.8		.3	55.5
Delaware											6.0			6.0
Georgia							16.4				9.4		.1	25.9
Idaho				7.7				6.5					.3	14.5
Kansas	9.5										3.0		.1	12.6
Kentucky				20.3				12.4			11.0			43.7
Louisiana											1.5			1.5
Michigan										7.4	18.9			26.3
Minnesota											116.8		.1	116.9
Mississippi	8.9										9.3			18.2
Missouri											10.7		.1	10.8
Montana				9.1				10.1						19.2
Nebraska											7.4			7.4
Nevada				23.5				26.8					.1	50.4
New Hampshire											2.9			2.9
New Jersey													.3	.3
New Mexico								39.7			2.1		.2	42.0
New York											7.7			7.7
North Carolina					6.7						.1			6.8
North Dakota				140.5							8.0			148.5
Ohio									0.4	1.9	10.1		.1	12.5
Oklahoma											22.6		.1	22.7
Oregon	1.9			.7			.6		16.5	6.1	.4		.4	26.6
South Carolina											11.9		.1	12.0
South Dakota	8.0			1.0							12.4			21.4
Tennessee	1.1									14.4	16.1		.1	31.7
Texas	3.6			1.5	24.5		10.7			11.8	92.7		.5	145.3
Utah				5.5				81.3			1.1		.4	88.3
Virginia		7.4		2.0						7.6	6.5		.3	23.8
West Virginia													.1	.1
Wisconsin											11.1			11.1
Wyoming	.8			19.2				12.2						32.2
Total	34.5	7.4		234.4	31.2		27.7	312.1	16.9	49.2	448.7		4.8	1,166.9

TABLE 24.—*Mileage of Federal-aid roads, by types of construction, by States, under stage construction, on June 30, 1933*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							
Alabama	0.4						1.6	22.8		14.5	70.8		0.2	110.3
Arizona				5.7				120.2					.8	126.7
Arkansas	15.6			2.5	8.9			10.7			50.2		1.1	89.0
California	5.9				2.7			10.8		16.4	19.1		.2	55.1
Colorado				11.0				7.7			.1		.3	19.1
Connecticut											5.3			5.3
Delaware	7.8										8.1			15.9
Georgia	16.5		18.5		23.2		55.8	5.2		10.0	50.7		.7	180.6
Idaho				9.0				104.8					.1	113.9
Illinois	3.6										55.8		1.2	60.6
Indiana											20.7			20.7
Iowa											38.5			38.5
Kansas	6.0							39.1	0.3	4.3	11.0		.3	61.0
Kentucky				38.9						26.6	56.4		.1	122.0
Louisiana	2.0										22.3		.5	24.8
Maine											.3			.3
Maryland										1.5				1.5
Massachusetts									2.1		2.8			4.9
Michigan	1.0			5.4							90.6		.1	97.1
Minnesota	40.3			6.6							93.0			139.9
Mississippi	20.3			.2						19.4	57.0		1.0	97.9
Missouri											16.9		.1	17.0
Montana	3.5			134.4				117.6					.3	255.8
Nebraska	41.3	2.6						18.7			94.0		3.3	159.9
Nevada	12.6			23.5				81.5		5.4	3.9		.6	127.5
New Hampshire									.4				.1	.5
New Mexico	8.0			13.0	15.0			65.6					1.9	103.5
New York										2.9	29.0		.1	32.0
North Carolina			16.9		7.3			3.4			.3		.2	28.1
North Dakota	19.5			192.7	10.8			185.6		1.4			.3	410.3
Ohio										32.2	19.2	0.1	.8	52.3
Oklahoma	6.9										67.7		.1	74.7
Oregon	23.5			18.5			5.0		11.7	.6	14.8		.3	74.4
Pennsylvania											14.0			14.0
Rhode Island											.2			.2
South Carolina			122.8		18.3						13.5		.1	154.7
South Dakota	42.2			31.7				117.7			10.1			201.7
Tennessee											29.2			29.2
Texas	85.5			61.9	91.7		41.5			28.8	190.9		2.5	502.8
Utah				20.9				13.3		2.1				36.3
Virginia		1.3		4.2		15.1				4.4	27.6		.1	52.7
Washington	.2			8.9							.5		.1	9.7
West Virginia							3.7				4.4			8.1
Wisconsin	7.8			4.7							89.1		.3	101.9
Wyoming	20.5			51.9				65.3					.2	137.9
Total	390.9	3.9	158.2	645.6	177.9	15.1	107.6	990.0	14.5	170.5	1,278.0	.1	18.0	3,970.3

TABLE 25.—*Mileage of Federal-aid roads, by types of construction, by States, approved for stage construction, June 30, 1933*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							
Arizona								5.8					0.1	5.9
Arkansas					1.4			14.3						15.7
California								2.0						2.0
Colorado				0.2										.2
Idaho								3.4						3.4
Indiana											5.3			5.3
Kansas								3.1						3.1
Kentucky				6.5							7.4			13.9
Maine									1.9					1.9
Michigan											.8			.8
Mississippi	4.1												.1	4.2
Missouri											16.6			16.6
Montana				7.8				4.2						12.0
New Hampshire											.7			.7
New Mexico											5.1			5.1
North Carolina					.3									.3
North Dakota				73.5										73.5
Ohio										2.5	.8			3.3
Oregon								1.3			.3			1.6
South Dakota				.3				28.8						29.1
Texas	17.9			.3									.1	18.3
Utah								11.5			.9			12.4
Vermont								6.5						6.5
Wisconsin											.7		.2	.9
Total	22.0			88.6	1.7			80.9	1.9	2.5	38.6		.5	236.7

TABLE 26.—*Net changes of mileage in the types of Federal-aid improvement on the Federal-aid highway system during the fiscal year 1933*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							
Alabama	−29.9	−11.4		−18.5							10.0		0.2	−49.6
Arizona	−20.6	−9.7		−70.6				151.2		0.8	−.8			50.3
Arkansas	−1.5			−21.3							−4.8		.2	−27.4
California	−.5			−17.3		−5.0		70.4	−2.6	33.6	93.5		−.6	171.5
Colorado	−7.9			82.6		−2.7		162.2			22.4		3.9	260.5
Connecticut	2.0			3.1			5.3				4.3		.4	15.1
Delaware	1.2			10.2						.2	23.2		.6	35.4
Florida							12.6			.4	9.6		.5	23.1
Georgia	38.6	−89.9		12.1			79.5	.9	−1.9		130.0		1.1	170.4
Idaho	−31.2			−134.6		−45.4		343.3		−.9			.9	132.1
Illinois	27.2								.1	−4.9	439.3			461.7
Indiana	−9.7										295.3		1.8	287.4
Iowa	57.9			−34.9							166.4		.4	189.8
Kansas	−69.2	61.1		−48.3	−0.5	−.2		403.9	−.3	7.8	52.6	−1.2	4.2	409.9
Kentucky	−70.4			−30.3		−4.3		12.4		5.3	109.4		.5	22.6
Louisiana	−18.6			1.6							68.4		1.4	52.8
Maine				3.3	36.1				39.6		22.4		1.2	102.6
Maryland									32.4	18.4	42.9		.1	93.8
Massachusetts								−.3	31.1	−.2	25.3		2.7	58.6
Michigan	17.3			−4.2						9.8	243.5		1.3	267.7
Minnesota	52.6			−88.6							389.2		.3	353.5
Mississippi	48.1			−27.5							32.4		1.8	54.8
Missouri	3.7			64.7						−12.8	254.3		1.3	311.2
Montana	−44.2			163.1				128.4		.1			1.5	248.9
Nebraska	14.5	−132.3						75.0			48.1		−.8	4.5
Nevada	−4.8			−75.2				171.2	−14.7	13.7	−19.4		.1	70.9
New Hampshire						−.6			3.6	−.6	24.5		.1	27.0
New Jersey				.1							20.1		1.2	21.4
New Mexico	6.1			−79.9				119.4			4.6		.6	50.8
New York	−5.2			10.1					15.0	25.4	197.7		.2	243.2
North Carolina	−.1	4.6	44.1	10.6	25.3	7.0	8.9	15.1	−.3	14.4	2.1		.7	132.4
North Dakota	−368.0			668.7				60.2		.1	8.0		.4	369.4
Ohio	3.2			10.0		−.2			−.6	−8.0	151.2	36.0	7.9	199.5
Oklahoma	91.6			−13.6							127.2		1.8	207.0
Oregon	−34.9			21.7	2.3	−2.2	23.1	4.8	111.8	−17.3	−3.4		1.8	107.7
Pennsylvania	2.6					165.4				−5.3	100.1	.1	1.3	264.2
Rhode Island	5.8								3.6	−3.0	9.2		.5	16.1
South Carolina		−137.0									85.7		.2	−51.1
South Dakota	42.8			79.4	38.5			62.7		4.9	36.9		.7	265.9
Tennessee	−56.6								−11.6	42.7	66.0		.6	41.1
Texas	−68.7	−11.0		−123.0	148.3	−14.4	73.5	−9.1	−8.9	10.7	303.5		10.2	311.1

TABLE 26.—*Net changes of mileage in the types of Federal-aid improvement on the Federal-aid highway system during the fiscal year 1933*—Continued

State	Graded and crained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							
Utah	−14.0			30.3		−88.3		145.7		.5	8.0		.6	82.8
Vermont				9.5				16.1	3.1		25.5		.5	54.7
Virginia	25.6	34.1		−2.2		33.8	4.0		−1.1	7.6	−30.9		.5	71.4
Washington	18.4			57.0							56.7		.7	132.8
West Virginia	4.8			−3.8					.6		30.4	−.3	.6	32.3
Wisconsin	6.3	−.6		−72.3							232.2		.7	166.3
Wyoming	−56.5	7.0		199.1				134.3					1.6	285.5
Hawaii	−3.6								36.1				.6	33.1
Total	−445.8	−285.1	44.1	571.1	250.0	42.9	206.9	2,067.8	235.0	143.4	3,912.8	34.6	59.0	6,836.7

TABLE 27.—*Federal-aid apportionment, and the amounts paid to the States for the fiscal year 1933, and the unobligated balance of the total apportionment on June 30, 1933*

State	Apportionment fiscal year 1933	Paid to States during the fiscal year 1933	Unobligated balances of total apportionment on June 30, 1933
Alabama	$2,251,487.72	$1,577,192.89	$3,199,828.75
Arizona	1,556,080.80	1,521,733.57	1,610.68
Arkansas	1,846,477.60	929,977.49	663,644.66
California	4,140,910.53	3,698,351.31	117,095.88
Colorado	1,988,953.60	2,185,645.98	269,439.58
Connecticut	687,401.80	370,196.56	183,167.11
Delaware	529,375.00	401,968.10	
Florida	1,437,372.40	1,309,949.87	989,164.32
Georgia	2,753,344.80	2,716,911.99	100,636.93
Idaho	1,330,448.00	1,315,840.41	73,920.51
Illinois	4,476,553.80	4,696,333.40	95,967.25
Indiana	2,698,897.20	3,150,523.32	209,145.99
Iowa	2,799,805.20	2,535,126.77	59,251.82
Kansas	2,889,065.80	2,435,972.62	153,217.33
Kentucky	1,994,012.00	1,517,615.33	48,791.33
Louisiana	1,569,830.67	1,744,791.99	
Maine	944,168.20	1,364,815.44	76,304.51
Maryland	895,409.60	792,361.75	
Massachusetts	1,511,241.00	2,481,476.40	351,632.06
Michigan	3,338,014.60	3,758,635.13	175,723.01
Minnesota	2,976,273.40	2,946,417.36	34,304.16
Mississippi	1,907,440.80	1,119,779.63	2,952,041.86
Missouri	3,346,264.88	3,020,038.58	8,827.28
Montana	2,230,177.00	2,957,527.27	401,817.97
Nebraska	2,256,040.80	2,908,956.42	49,318.84
Nevada	1,421,688.63	1,382,302.60	117,662.21
New Hampshire	529,375.00	419,190.18	64,377.21
New Jersey	1,463,483.60	1,151,062.66	109,558.29
New Mexico	1,732,343.40	1,245,058.57	85,464.22
New York	5,342,506.80	5,297,698.28	355,781.37
North Carolina	2,550,007.00	1,830,951.42	977,044.05
North Dakota	1,710,936.60	1,463,221.78	416,198.04
Ohio	3,971,690.40	4,869,738.14	190,835.32
Oklahoma	2,553,034.80	1,703,492.27	433,937.87
Oregon	1,767,475.80	1,855,778.01	56,880.55
Pennsylvania	4,640,667.40	4,150,584.63	53,641.77
Rhode Island	529,375.00	414,113.90	70,834.03
South Carolina	1,469,603.80	1,088,720.55	12,443.92
South Dakota	1,765,764.40	1,411,030.29	169,101.27
Tennessee	2,302,158.60	2,420,799.23	576,790.79
Texas	6,811,084.83	6,330,692.65	49,990.22
Utah	1,223,723.28	1,181,546.86	
Vermont	529,375.00	505,130.44	151.97
Virginia	1,992,380.60	1,538,556.73	194,541.87
Washington	1,681,216.40	1,698,496.48	59,732.72
West Virginia	1,162,217.20	1,177,605.05	49,516.08
Wisconsin	2,640,713.00	2,614,088.36	265,183.36
Wyoming	1,359,009.40	1,043,959.29	151,122.56
Hawaii	529,375.00	1,014,353.07	514,689.68
Total	106,034,256.14	101,266,331.02	15,190,331.20

NATIONAL-FOREST-ROAD CONSTRUCTION

The appropriations made for improvement of roads in the national forests recognize and provide separately for two principal classes of road, designated, respectively, as forest highways and forest-development roads. Forest-development roads, as the name implies, are roads which serve primarily for the development of the forests and which are needed for the protection and administration of the forests. In the main they are lightly traveled and entail no large expense for their improvement. Forest highways are roads of a higher order of traffic importance, generally those joining sections of the Federal-aid or State highway systems outside the forests or important community-service roads, and requiring, in consequence, types of improvement that are generally more expensive than those required for the forest development roads.

For both classes of roads the act of May 5, 1930, authorized an appropriation of $12,500,000 to be available in the fiscal year 1933 and thereafter until expended. In accordance with the provisions of the Federal Highway Act $3,000,000 of this sum was set apart for forest-development roads, and the remainder, $9,500,000, was available for forest-highway construction.

For the construction of forest highways there was subsequently appropriated by the Emergency Relief and Construction Act of 1932 an additional sum of $5,000,000 to be available for expenditure during the fiscal year 1933 only; but

the period of availability was later extended through the fiscal year 1934 by act approved March 3, 1933.

In the main, the work supervised by the Bureau of Public Roads is limited to the construction of forest highways, for which the combined sums authorized and appropriated for the fiscal year 1933 were $14,500,000, as above noted. Forest-development road work generally is administered by the Forest Service. While this definition of the work of the two bureaus is approximately correct, the exact line of separation is drawn between what are termed major and minor projects. Projects of the major class which, under the rules and regulations, are administered by the Bureau of Public Roads, include all projects on the forest-highway system, except those which do not require the technical services of a highway-engineering organization and those having an estimated average cost of less than $2,000 per mile, and in addition, those forest-development road projects of estimated average cost in excess of $5,000 per mile and those requiring the technical services of a highway-engineering organization.

In accordance with requirements of the governing rules and regulations a system of forest highways has been designated by concurrent action of the several State highway departments, the Forest Service, and this Bureau, approved by the Secretary of Agriculture. Also as required by the rules and regulations the highways constituting this system have been classified as follows:

Class 1. Forest roads forming sections of the Federal-aid highway system, either wholly within or, when so designated by the Forester and the Chief of the Bureau of Public Roads, partly without and adjacent to the national forests.

Class 2. Forest roads, not of class 1, which are parts of approved State highway systems, when so designated by the Forester and the Chief of the Bureau of Public Roads.

Class 3. All other forest roads, of primary importance to counties or communities.

The roads which, according to these definitions, had been classified as forest highways, had an aggregate length on June 30, 1933, of 16,458.3 miles, classified as shown in table 28.

TABLE 28.—*Classification of the mileage of the forest-highway system as revised to June 30, 1933*

State	Mileage of forest-highway system			
	Class 1	Class 2	Class 3	Total
Western:				
Alaska			459.9	459.9
Arizona	320.6	245.0	495.9	1,061.5
California	578.4	785.8	962.8	2,327.0
Colorado	508.0	1,113.0	104.0	1,725.0
Idaho	687.2	144.0	212.7	1,043.9
Montana	628.3	335.8	238.0	1,202.1
Nevada	104.0	190.6	166.8	461.4
New Mexico	164.0	517.0		681.0
Oregon	524.7	411.7	435.1	1,371.5
South Dakota	227.0		86.0	313.0
Utah	58.6	539.3	139.2	737.1
Washington	386.5	135.4	247.9	769.8
Wyoming	387.3	37.0	217.7	642.0
Total	4,574.6	4,454.6	3,766.0	12,795.2
Eastern:				
Alabama	4.0		31.0	35.0
Arkansas	192.3	144.3	90.5	427.1
Florida	39.7	81.0	36.3	157.0
Georgia	41.8	37.5	68.7	148.0
Louisiana	36.3	105.7	12.0	154.0
Maine			11.0	11.0
Michigan	49.9	108.5	150.3	308.7
Minnesota	89.5		222.2	311.7
Mississippi	32.0	13.0	51.0	96.0
Nebraska			28.8	28.8
New Hampshire	41.5	60.5	49.0	151.0
North Carolina	102.0	105.3	48.3	255.6
Oklahoma	31.5		70.5	102.0
Pennsylvania	134.0	248.0	19.0	401.0
Puerto Rico			21.0	21.0
South Carolina		26.0	11.0	37.0
Tennessee	83.8	105.0	79.0	267.8
Vermont	7.0		12.0	19.0
Virginia	79.0	117.9	210.0	406.9
West Virginia	76.0	102.0	62.0	240.0
Wisconsin	5.0	48.5	31.0	84.5
Total	1,045.3	1,303.2	1,314.6	3,663.1
Grand total	5,619.9	5,757.8	5,080.6	16,458.3

TABLE 29.—*Mileage of completed forest-highway projects, by States* [1]

State	Mileage of forest-highway projects completed		State	Mileage of forest-highway projects completed	
	During 1933	Total to June 30, 1933		During 1933	Total to June 30, 1933
Western:			Eastern:		
Alaska	3.7	246.6	Alabama		5.1
Arizona	59.8	514.3	Arkansas	18.4	93.4
California	55.8	595.2	Florida	3.2	72.3
Colorado	29.7	445.9	Georgia		21.4
Idaho	36.2	626.9	Michigan	4.9	21.1
Montana	16.1	472.7	Minnesota	16.1	85.0
Nevada	1.1	143.7	New Hampshire		8.1
New Mexico	32.6	266.5	North Carolina		43.3
Oregon	47.6	855.6	Pennsylvania		1.8
South Dakota	4.1	51.9	South Carolina		15.6
Utah	2.2	356.5	Tennessee		37.4
Washington	19.5	259.5	Virginia	3.3	19.3
Wyoming	5.1	330.7	West Virginia		3.6
Total	313.5	5,166.0	Total	45.9	427.4
			Grand total	359.4	5,593.4

[1] A revision of the system in Florida omits 8.0 miles previously reported as improved, and corrections of previously reported figures total 0.2 mile.

During the past year improvements were constructed on 359.4 miles of the forest-highway system, bringing the total mileage improved to date with Federal funds to 5,593.4 miles. Of the mileage improved during the year, 313.5 miles were in the Western States and Alaska, and the remaining 45.9 miles were in the forests of 5 Eastern States. Of the total mileage improved to date, 5,166.0 miles are in the West and 427.4 in the East.

The mileage of forest-highway projects constructed during the year and to date by States is shown in table 29.

On June 30, 1933, work was in progress under the supervision of the Bureau of Public Roads on 1,067.4 miles of road at a total estimated cost of $11,282,213.78. Work estimated to cost $1,933,827 had been planned but not yet started; and there was a balance of authorized funds not yet obligated to definite projects amounting to $1,722,113.70.

ROAD CONSTRUCTION IN THE NATIONAL PARKS

Road construction in the national parks by agreement with the National Park Service is supervised by the Bureau of Public Roads. During the fiscal year 1933, 174 miles of road were constructed, making a total of 674 miles thus far improved.

The mileage constructed during the fiscal year and to date in the several parks is shown in table 30.

The most important project constructed for the National Park Service under supervision of this bureau is the Wawona Tunnel in Yosemite National Park. This tunnel on the Wawona road connecting Yosemite Valley with the Mariposa Grove at Big Trees is 0.8 mile in length. It was completed during the past year. The great length of the tunnel made it necessary to provide lighting and ventilation.

An outstanding project of interest to the Eastern States which was completed during the year is the Skyline Drive along the ridge of the Blue Ridge Mountains in the proposed Shenandoah National Park in Virginia. The completed road is 40 miles in length and for 35 miles it runs along or near the crest of the Blue Ridge Mountains through a section that has been visited in the past only by mountain hikers. Near the beginning of the project at Panorama the road leads through Mary's Rock Tunnel, 600 feet in length. There is then presented a panorama of the foothills of the Blue Ridge Mountains and plains of Virginia extending as far as they eye can see. The entire completed section is a route of continuous scenic beauty. This section comprises about one third of the total improvement contemplated which will extend from Front Royal at the northern end of the park to near Waynesboro at the southern end.

TABLE 30.—*Mileage of national-park roads improved under the supervision of the Bureau of Public Roads*

National park or monument	Mileage completed under supervision of the Bureau		National park or monument	Mileage completed under supervision of the Bureau	
	During fiscal year 1933	Total to June 30, 1933		During fiscal year 1933	Total to June 30, 1933
Acadia	0.3	3.9	Petrified Forest National Monument	0.4	16.7
Bryce Canyon	14.4	14.4	Rocky Mountain	28.1	36.8
Colonial National Monument		10.0	Scotts Bluff National Monument	.6	.6
Crater Lake	14.8	38.1	Sequoia	4.1	32.8
Devils Tower National Monument		.3	Shenandoah	40.1	40.1
General Grant	2.4	6.4	Wind Cave	1.4	6.7
Glacier	10.4	47.3	Yellowstone	3.4	92.9
Grand Canyon	35.9	129.7	Yosemite	1.8	56.4
Hawaii	9.0	20.2	Zion	.6	15.5
Lassen Volcanic		[1] 30.4			
Mesa Verde	2.2	20.4	Total	174.4	674.4
Mount Rainier	4.5	54.8			

[1] Correction of previously reported figure.

The Fall River Highway in the Rocky Mountain National Park, Colo., 28 miles in length, was built at a cost of $900,000. The road is located east of the Continental Divide on the main east-and-west road traversing the park. The entire project is located at a very high elevation. Some of the highest and most rugged peaks of the Rocky Mountains may be seen along this route.

Other park projects constructed during the past year include a parking area on the Cadillac Mountain Road in Acadia National Park, the Rim Road in Bryce Canyon National Park and a section of the Scotts Bluff Road in Scotts Bluff National Monument.

Two large bridges were constructed in Petrified Forest National Monument. These bridges are known as the Rio Puerco and Dry Creek Bridges and are located on the main north and south highway which was completed during the fiscal year 1932.

RESTORATION OF FLOOD-DAMAGED ROADS

During the last fiscal year there has been no addition to the appropriations previously made for relief of the States on account of damage to roads by floods.

Of the various appropriations, those made for Vermont and New Hampshire have been completely expended; of those made to Kentucky, Arkansas, Louisiana, Mississippi, Missouri, Alabama, and Georgia, various amounts remain unobligated, and that made to South Carolina is entirely obligated but in small part unpaid. Although less than the total sum appropriated for Florida has been paid to the State, the sum of $77,296.48 actually paid is the whole payment that will be made.

The appropriations made for all of the States except Alabama, Georgia, and South Carolina had no definite term of availability. In the three exceptional cases the original appropriations were for the fiscal year 1931, but the terms of availability have been extended by subsequent legislation, the most recent being the act of July 7, 1932, extending availability until June 30, 1933 and that of March 3, 1933, further extending the term of each to June 30,1934.

In the cases of Georgia and South Carolina, portions of the appropriations originally reserved to meet Federal administrative costs were unneeded for that purpose and released for payment to the States during the past year.

TABLE 31.—*Flood relief appropriated, amounts paid to States, and the unobligated balance of the appropriation on June 30, 1933*

State	Appropriated	Paid to the States to June 30, 1933	Unobligated balance
Vermont	$2,654,000.00	$2,654,000.00	
New Hampshire	653,300.00	653,300.00	
Kentucky	1,889,994.00	935,280.41	$666,763.24
Total	5,197,294.00	4,242,580.41	666,763.24
Arkansas	1,800,000.00	1,477,693.56	322,306.44
Louisiana	967,582.00	786,271.13	181,310.87
Mississippi	628,000.00	345,266.57	282,733.43
Missouri	258,418.00	119,428.31	130,865.95
Total	3,654,000.00	2,728,659.57	917,216.69
Alabama	[1] 1,618,500.00	481,083.81	1,137,416.19
Georgia	[1] 505,167.50	433,687.63	19,152.05
South Carolina	[1] 801,361.00	770,682.05	
Florida	80,307.00	77,296.48	
Total	3,005,335.50	1,762,749.97	1,156,568.24
Grand total	11,856,629.50	8,733,989.95	2,740,548.17

[1] Does not include fund allowable for administration.

The mileage of road improved under the relief acts up to the end of the fiscal year and the corresponding total cost and Federal payment are given in table 32. Similar information for roads completed during the past year, including 6.3 miles on which final payment had not been made, is presented in table 33; and for roads under construction, including 1.9 miles in Georgia approved for construction, in table 34.

TABLE 32.—*Total cost, flood relief, and mileage improved to June 30, 1933*

State	Total cost	Flood relief	Miles
Vermont	$5,651,965.83	$2,654,000.00	61.2
New Hampshire	1,408,479.45	653,300.00	29.1
Kentucky	1,799,206.78	750,341.07	103.2
Total	8,859,652.06	4,057,641.07	193.5
Arkansas	843,914.04	405,711.21	49.8
Mississippi	11,433.59	3,563.66	.3
Total	855,347.63	409,274.87	50.1
Alabama	319,797.49	155,615.15	41.7
Georgia	362,649.69	176,502.53	4.4
South Carolina	1,230,791.05	559,721.98	18.1
Total	1,913,238.23	891,839.66	64.2
Grand total	11,628,237.92	5,358,755.60	307.8

TABLE 33.—*Total cost, flood relief and mileage of roads which were completed during the fiscal year 1933*

State	Estimated total cost	Flood relief allotted	Miles
Kentucky	$387,202.26	$162,125.66	35.8
Georgia	321,441.48	156,143.65	4.3
South Carolina	336,363.72	156,300.00	3.6
Total	657,805.20	312,443.65	7.9
Grand total	1,045,007.46	474,569.31	43.7

TABLE 34.—*Total cost, flood relief, and mileage of roads under construction and approved for construction on June 30, 1933*

State	Estimated total cost	Flood relief allotted	Miles
Georgia	$129,601.70	$56,304.01	2.2
Kentucky	1,090,138.05	472,889.69	108.3
South Carolina	533,541.46	241,639.02	4.2
Total	1,753,281.21	770,832.72	114.7

The mileage of the several surface types represented in flood-relief roads completed during the fiscal year 1933 is given in table 35, and the total mileages completed, and under construction and approved for construction are given in tables 36 and 37, respectively.

The amounts of the several appropriations (less sums reserved for Federal administration in the cases of Alabama, Georgia, and South Carolina), the amounts paid the States up to June 30, 1933, and the unobligated balances for each State are shown in table 31. Flood relief paid to the States during the fiscal year 1933 is given below:

Kentucky	$267,528.92
Missouri	119,428.31
Georgia	15,479.62
South Carolina	36,659.82
Florida	1,243.65
Total	440,340.32

TABLE 35.—*Mileage of the various types of flood-relief roads completed during the fiscal year 1933*

State	Graded and drained	Macadam, treated	Portland cement concrete	Bridges and approaches	Total
Georgia		3.3	0.4	0.6	4.3
Kentucky	35.7			.1	35.8
South Carolina	.1		2.6	.9	3.6
Total	35.8	3.3	3.0	1.6	43.7

TABLE 36.—*Mileage of the various types of flood-relief roads improved to June 30, 1933*

State	Graded and drained	Sand-clay, untreated	Gravel, untreated	Gravel, surface treated	Macadam, surface treated	Bituminous macadam	Portland cement concrete	Bridges and approaches	Total
Vermont			7.0	9.2		6.1	32.5	6.4	61.2
New Hampshire				2.9	4.9	2.3	18.4	.6	29.1
Kentucky	102.2							1.0	103.2
Total	102.2		7.0	12.1	4.9	8.4	50.9	8.0	193.5
Arkansas	16.1		31.1				.3	2.3	49.8
Mississippi							.3		.3
Total	16.1		31.1				.6	2.3	50.1
Alabama	17.4	15.9	7.6					.8	41.7
Georgia					3.3		.4	.7	4.4
South Carolina	10.1						5.3	2.7	18.1
Total	27.5	15.9	7.6		3.3		5.7	4.2	64.2
Grand total	145.8	15.9	45.7	12.1	8.2	8.4	57.2	14.5	307.8

TABLE 37.—*Mileage of the various types of flood-relief roads under construction and approved for construction on June 30, 1933*

State	Graded and drained	Sand-clay, untreated	Gravel, untreated	Mac-adam, treated	Portland cement concrete	Bridges and approaches	Total
Georgia		0.4		0.3	1.2	0.3	2.2
Kentucky	103.2		4.6			.5	108.3
South Carolina	2.9	.3				1.0	4.2
Total	106.1	.7	4.6	.3	1.2	1.8	114.7

MOUNT VERNON MEMORIAL HIGHWAY

With the exception of a few finishing details the work of constructing the Mount Vernon Memorial Highway was completed during the fiscal year 1932. The remaining work was completed early in the last fiscal year, and the control of the highway was transferred to the Office of Public Buildings and Public Parks of the National Capital.

Ceremonies celebrating the formal opening of the road were held at the Mount Vernon terminus on November 15, 1932, attended by members of the American Association of State Highway Officials then in convention at Washington. Addresses were made by Secretary of Agriculture Arthur M. Hyde, Senator Simeon D. Fess, vice chairman of the United States Commission for the Celebration of the Two Hundredth Anniversary of the Birth of George Washington, Lt. Col. U. S. Grant, 3d, Director of the Office of Public Buildings and Public Parks of the National Capital, and Frederic E. Everett, president of the American Association of State Highway Officials and chief engineer of the State Highway Department of New Hampshire.

INTER-AMERICAN HIGHWAY

All field operations in connection with the reconnaissance survey of the proposed inter-American highway from Panama to the United States were completed before the end of the fiscal year. The Panama City office of the Bureau engineers who have been engaged in this work since 1930 was restored late in May to the Central Roads Board of Panama, by which it had been kindly loaned. It will be kept open in future by the Central Roads Board as a center of information on the proposed highway.

The reconnaissance operations included ground surveys through the Republics of Panama, Costa Rica, Nicaragua, Honduras, and Guatemala, in which the American engineers and representatives from the local governments covered approximately 900 miles afoot or on horseback. Aerial photographic surveys of the region along the route were also made by the United States Army Air Corps operating from its Panama base at France Field.

A comprehensive report of this important project is now being compiled. It will contain complete engineering details and in addition will outline the general and economic characteristics of the countries to be traversed by the proposed highway. From an engineering standpoint, the construction of an all-weather road 3,200 miles long, from Panama City, Republic of Panama, to Nuevo Laredo, Mexico, is entirely practicable; more than 1,200 miles of the total route, in fact, are already passable to motor vehicles in all seasons, and 1,000 miles more are passable in the dry season. Construction work is being actively pushed on a number of local stretches of road, particularly in Panama and Mexico.

As an instrument for developing the potential resources of and strengthening our commercial and social relations with the Central American Republics, it is believed that the construction of the inter-American highway is justifiable from an economic standpoint, and that the project does not contemplate expenditure of money and labor disproportionate to the benefits eventually to be realized by the United States and the republics concerned.

TRANSPORTATION AND ECONOMIC AND STATISTICAL INVESTIGATIONS

MICHIGAN TRAFFIC SURVEY

The report of the traffic survey conducted in Michigan in cooperation with the State highway department in 1930 and 1931 was published in the February 1933 issue of Public Roads. Among the more important results of the survey

was the determination of the relative utilization of the State highway system, the county and township highways, and city streets. The survey revealed that 50 percent of all Michigan traffic is carried by the streets of cities in the State, 5 percent by the township roads, 12 percent by county roads, and 33 percent by the State highway system.

On the 7,691 miles of main roads included in the State highway system the average daily traffic was found to be 1,144 vehicles. On the 17,175 miles classified at the time of the survey as county roads the traffic averaged 190 vehicles daily, and on the 60,214 miles of township roads, most extensive and least important of the State's road mileage, the traffic averaged only 22 vehicles per day. On 25 percent of these roads the survey showed the traffic to be 10 vehicles or less daily.

Of the traffic on city streets 69 percent was found to be local to the city, and 31 percent was found to originate at, or destined to, points beyond the city limits. As an incident of the survey it was found that 2½ million motor tourists visited the State during the survey year with estimated total expenditures of $274,000,000. Over 80 percent of these tourists were found to be from neighboring States and Canada.

WASHINGTON REGIONAL-AREA TRAFFIC SURVEY

Field work of the Washington regional-area traffic survey was finished in September 1932, and a report is now in preparation. Traffic information will be available in sufficient detail to serve as the basis for development of a connected system of main highways in the Washington regional area and to indicate desirable priority of construction. A complete analysis has been made of the necessity for the construction of several alternate routes, including bridges, to relieve congested existing routes, and studies have also been made of possible relocations and extensions of several existing highways. The data are sufficiently inclusive and extended to indicate with reasonable accuracy the minimum volume of traffic which would be carried upon the proposed new routes. It is believed that it will be possible to make recommendations, the adoption of which will result in greater economy and convenience to traffic upon certain of the projected routes, and in large savings in right-of-way and construction costs by modification of prior proposals that have not been based upon factual information with regard to traffic movements.

INDIANA TRAFFIC SURVEY

As the fiscal year closed, field work on a 12-month survey of traffic in 11 representative counties of Indiana was nearing completion, being scheduled to terminate in August. As the first comprehensive traffic census ever made in Indiana, its results, showing relative proportions of foreign and domestic traffic on township, county, and State roads will be of importance to State authorities. A report of the survey will be started upon completion of the field operations.

NEW JERSEY TRAFFIC SURVEY

A survey of traffic upon the entire State highway system of New Jersey and upon a limited mileage of the principal county routes, begun in 1932, is scheduled to be completed September 1, 1933. The resulting report will contain data with regard to the origin and destination of truck traffic, the nominal capacities and body types of trucks, their classification as owner operated, contract haulers, or common carriers, and as of interstate or intrastate operation, the origin and destination of all vehicles observed at the Hudson River and Delaware River crossings, and the determination of the proportions of passenger-car traffic upon each of the highway systems that are local to each county or that originate in other areas. Special studies will be made of the data in connection with the necessity for additional highway facilities in the State.

TRAFFIC CAPACITY AND INTERSECTION STUDIES

Research has been continued into the efficiency of various types of traffic control at highway intersections. A large number of vehicles have been electrically timed through intersections of different types, and data for comparative study have been obtained by the experimental varying of signal cycles or the making of observations before and after the inauguration of new control systems.

Observations of traffic on United States Route No. 1 between Jersey City and Newark, N.J., made in connection with the traffic survey in that State, have indicated that the new high-level viaduct is saving highway users approximately 1 million "vehicle-hours" per year. Speed of vehicles was determined by the

recording of license-plate numbers and time of passage at both ends of the route, before and after its improvement. The results of these observations will be published.

TESTS OF HIGHWAY SIGNS

Tests to determine the relative efficiency of reflector buttons designed for use in highway signs and the attention-arresting values of sign color combinations, undertaken in cooperation with the Bureau of Standards at the request of the American Association of State Highway Officials and the National Conference on Street and Highway Safety, have been completed. This investigation involved the determination of the personal acuity and rapidity of perception of 121 individuals as measured by a tachistoscope adjusted to control definitely the time interval of free observation. The conclusions reached indicate that black letters on a yellow background are more easily read than black letters on white background or white letters on black background, and that a reflecting button with a diameter of 0.76 inch is relatively more efficient for rural use than reflecting units of 0.95 or 0.58 inch. This advantage is not so apparent under conditions usually obtaining in city streets where the absence of glare under dimmed headlights increases the value of the small button.

UNIFORMITY IN MOTOR-VEHICLE REGULATIONS

The complicated situation resulting from the diversified motor-vehicle legislation existing in the 48 States and the District of Columbia was the object of study by the Bureau throughout the year, with representatives participating in several conferences of State administrators and vehicle-operators' associations. The entire problem of motor-vehicle regulation was analyzed in a report published in the December 1932 issue of Public Roads. Movements toward greater uniformity in State legislation have been launched in various parts of the United States, and the Bureau has been lending its cooperation to these efforts.

STUDIES OF TAXATION IN WISCONSIN, MICHIGAN, AND ILLINOIS

Results of extensive inquiry into the finances of Wisconsin, Illinois, and Michigan with special reference to highways were made available to the public in the April, May, and June (1933) issues of Public Roads. All three studies related to the calendar year 1930 as the latest year for which complete data were available. The purpose of the investigations was to establish the relation of highway taxes paid from different sources and by different groups of citizens, based on local administrative units and the highway service furnished, and to lay down a broad basis for adjustment of highway taxes on a rational plan.

Many important facts regarding highway financing may be adduced from these surveys. In all three of the States covered, it was found that rural property paid no tax for urban streets, but a part of the tax on urban property was expended on local township roads. A striking similarity was found to exist between the proportion of motor-vehicle imposts paid by rural and urban motor-vehicle owners and the proportion of highway travel by these owners; for example, rural motor-vehicle owners (residents of townships) in Wisconsin paid 33.9 percent of the total motor-vehicle imposts expended on all classes of roads and streets, and travel by these same rural owners made up 31.9 percent of the total travel on all classes of roads and streets, while the corresponding percentages for city and village motor-vehicle owners were, respectively, 66.1 and 68.1 percent.

PRODUCTION COST STUDIES

ROAD CONSTRUCTION AS AN EMPLOYMENT MEASURE

The resort to highway construction as a means of furnishing employment for idle labor has emphasized the need of more precise knowledge of the amount of human labor entering into each of the various road building and maintenance operations, and how and to what extent the labor element varies when different methods and equipment are used. The collection of data bearing on these questions, in terms of the number of man-hours required to produce a given result, has been made a regular part of the production-cost studies.

Last year a study was made of the extent to which labor profits from the construction of high-type pavements in which mechanical equipment plays an important part. In this study the money paid out by States or communities for the construction of a concrete pavement was traced through its various exchanges showing how these expenditures extend to sand and gravel pits, stone quarries, cement and steel mills, to the manufacturers of equipment, repair parts, explo-

sives, gasoline, lubricating oils, and supplies, as well as to railroad and transportation companies, and to those who furnish them their supplies, equipment, and repairs, which extend from coal and ore mines to mills and factories. When thus traced, it was found not only that about 90 percent of the taxpayers' dollar was eventually paid to workers as wages and salaries, but also that a very large part of the industry of the country took an active part in the work and received a definite financial stimulus. A few more specialized studies have been made to show the extent to which particular industries or activities profit from normal highway work, such for example, as the freight obtained by railroads as a direct and indirect result of highway-construction activities.

A study was also made to discover the trend of costs in highway construction apart from the influence of such factors as changes in use of materials, specifications, and construction practices. This study led to the development of a set of index figures based on the average cost of 1 mile of highway composed of units of grading, surfacing, and structures in the same ratios of use as were found in the highway-construction program for the years comprising the base period. This index, which was published in Public Roads, July 1933, shows the trend in unit prices for excavation, surfacing, and structures, as well as for the composite mile of road improvement for the period 1922 to 1933.

The work in connection with carrying out the legislative provisions fixing minimum wage rates and maximum hours of employment on all road-construction projects involving the expenditure of Federal road funds has been carried on in about the same manner as in the past, although the volume has increased considerably. As a regular part of this work a monthly record of the number of persons actually employed in State and Federal road work is compiled.

STUDIES OF ROLLED CONCRETE PAVEMENTS

During the past year studies were made on the placing of two sections of rolled concrete pavement in which 5- to 7-ton tandem road rollers were used to consolidate a very lean and dry mix. In this work all methods of operation were practically the same as in the production of a standard concrete pavement, except certain operations behind the paver. The mix used was so lean that the mortar, while of about normal richness, was only sufficient in quantity to fill the voids in the coarse aggregate when the latter had been thoroughly consolidated by repeated passages of the tandem road roller. On both of the experimental sections a finishing machine was used ahead of the roller as a strike-off, although an ordinary heavy strike-off planer drawn by a winch on the paver would no doubt have been cheaper and apparently equally satisfactory for striking off the lean, harsh concrete mix at the desired height so that the consolidation produced by the roller would just bring the surface to the desired elevation. The second finisher was used behind the roller in the usual manner to spread such excess mortar as might be brought to the surface by the roller and to produce the customary smooth finish. With further experience in conducting the rolling and in designing the mix, this finishing machine may not be necessary, especially on secondary road work.

The rolling, which was begun immediately after the concrete had been spread and struck off, was carried on in much the same manner as in the construction of an ordinary broken-stone macadam surface and was continued until the surface was perfectly smooth and unyielding, and all the coarse particles were firmly interlocked and the mortar was just flushing to the surface. The regular grading of the coarse aggregate as employed in the standard methods of construction was used in both cases, although there were some indications that a grading in which a considerable portion of the intermediate or finer sizes was omitted might prove better.

This method, while still in an experimental stage, seems to have considerable promise of development for use on secondary roads and in regions where sand and cement prices are high. Tests of cores and beams and general observations indicate that it will produce a pavement in point of surface smoothness, density, and both beam and compressive strength, comparing favorably with pavements placed by standard methods containing from 1 to 1½ more bags of cement per cubic yard. The studies will be continued with a view of determining the possibility of developing the method for use in the improvement of secondary highways.

CONCRETE FROM CENTRAL MIXING PLANTS

Concrete for highway work is being supplied in increasing amounts from large central mixing plants that are usually equipped with mixers very much larger than those of the portable type in common use on highway-construction projects. Studies of two such plants equipped with 4- and 5-cubic-yard mixers indicate

quite clearly that, with an actual mixing time varying from 1 to 4 minutes, little or no appreciable increase in either beam or crushing strength and no improvement in the uniformity of distribution of the various ingredients throughout the batch are secured by mixing the batch longer than 1 minute. These tests also show that a grinding action takes place within the drum, the amount of which is directly proportional to the length of the mixing time. With the hard gravel aggregates used in these tests, the grinding was confined almost entirely to the sand, but with long mixing time the stone dust, or flour, thus produced was sufficient to have an appreciable effect on the slump. Thus, to produce a concrete of given slump, more water was necessary when the mixing time was long than when it was short.

METHODS OF BUILDING LOW-COST HIGHWAYS

In view of the increasing difficulty of obtaining sufficient funds to provide and maintain adequate local highway facilities, considerable attention has been devoted to the development of the most efficient methods of building low-cost bituminous surfaces. Two types of such surfaces have been developed—the so-called plant-mix and road-mix types. In the construction of surfaces of the first type the stone and bituminous material are mixed in some form of mechanical mixing plant, either stationary or portable, in much the same manner as standard bituminous concrete. Surfaces of the road-mix type, on the other hand, are constructed by mixing the stone and bituminous material in place on the road.

The methods employed in both types of operation vary a great deal. There are hardly any two localities in which exactly the same methods are used; but everywhere the effort is being made to produce satisfactory dustless surfaces suitable for light traffic by methods and with materials less expensive than those employed in the construction of the higher types of bituminous surfaces.

The Bureau has joined in these efforts with studies of both plant-mixing and road-mixing methods. The studies of the plant-mix type have been devoted largely to finding means of maintaining production rates in the face of a tendency to add refinements which jeopardize the essential low cost of the product. In the case of the road-mix type its work has been mainly a search for ways and means of simplifying and standardizing construction procedures and developing more effective and efficient mixing equipment. Progress along these lines has been gratifying and gives promise of definite results.

GRADING STUDIES

Studies of grading practices have been continued. The changes that have taken place in recent years in this important department of road work are most striking. In 1926 the power shovel in use on the average highway-grading job in the United States had a dipper rated at ¾-cubic-yard capacity and the 1¼- or 1½-cubic-yard horse-drawn wagon was the prevailing hauling equipment. Today our studies indicate that the average grading job is equipped with a shovel having a dipper capacity of 1¼ cubic yards, and that the 1½-yard shovel is now more common than the ¾ yard. Horse-drawn hauling equipment is now seldom seen, the prevailing type of hauling equipment being the heavy truck or large tractor-drawn wagon. A series of articles entitled "Power Shovel Operation in Highway Grading", has been revised and rewritten for publication in the near future.

The bulldozer has long been standard equipment on the dump and in building sidehill trails and minor roads. Recently the use of the bulldozer has been successfully extended to the longitudinal movement of earth and all loose or friable materials in regular highway-grading work. Studies of the operation of this type of equipment indicate that it should find considerable use in connection with the power shovel whenever the topography is broken or rugged and the hard rock is overlain by a considerable mantle of earth, deeply decomposed rock, or other friable materials. The essential requirements for successful use of the bulldozer as a grading unit are steep surface grades, relatively short hauls, and a material of which a load can be accumulated readily. If the material is hard, scarifying or blasting must be resorted to before the bulldozer can operate efficiently. Hard rock or hard shales can seldom, if ever, be fragmented sufficiently even by heavy blasting to make the use of the bulldozer economical. This type of material should be reserved for movement by the power shovel.

Studies of use of the elevating grader in highway work indicate that recent improvements—among them the provision of a separate power unit for operating the elevator belt—have extended the field within which this type of equipment may find profitable employment to include very slippery and very loose and sandy soils, in which operation was formerly impractical or impossible because of bull-

wheel slippage. Broadly speaking, however, the field of the elevating grader is still limited to the movement of earth reasonably free from roots and stones in level to gently rolling country. In a recent study, five elevating graders were observed working under favorable conditions in ground of this type for all of which the production averaged over 200 cubic yards of pay material loaded, hauled, and placed in the fill per hour of actual operation.

HIGHWAY-ACCOUNTING METHODS

Accurate, complete and up-to-date information in regard to the various activities of a highway department is essential to efficient and economical administration and control. The Federal Government is vitally interested in the attainment of the highest possible degree of efficiency in the functioning of the various State departments with which it cooperates in the construction of Federal-aid roads. For these reasons, the Bureau has continued the effort to further the development and installation of efficient accounting and statistical procedures that will provide the State administrative and engineering organizations with full and complete records of current income, expenditures, and accomplishments in highway construction, maintenance, and administration, and by their uniformity permit the accomplishments of one State to be fairly compared with those of another. Such a comparison is as yet largely impossible, except in a few States, because of the dissimilar form of the available records and the lack of a uniform nomenclature and procedure. The aim is to provide a system of accounts and records that will be economical in operation, will fully meet all accounting requirements of the Department, and will provide quickly and in practical form complete statistical information on any desired activity in which the Department is engaged. Cooperative work along these lines was carried on during the past year with the State highway departments of Arkansas, New Hampshire, and Indiana.

PHYSICAL RESEARCH

MOTOR-VEHICLE IMPACT INVESTIGATIONS

During the past year a report has been published covering in detail the study of the impact reactions produced by a heavy motor bus, mentioned in last year's report.

A limited study was made of the impact reactions of a heavy passenger car and of those of a light truck equipped with high-pressure pneumatic tires. Tests with these vehicles were made over actual pavement surfaces. The relation between the magnitude of the reactions developed and the frequency of occurrence was established for each vehicle and the trends of the data were compared with similar data obtained in the bus tests. A complete report of this study has been prepared.

Preparations have been made for the study of the effect on road surfaces of the suddenly applied forces of motor-vehicle impact. A definite program of tests has been outlined. This program includes a series of tests to determine the relative effects of static and impact forces on massive concrete specimens under carefully controlled conditions. For this work a specially designed pendulum-type impact machine has been designed and is being built. The program will also include comparative static and impact tests on actual pavement slabs to follow the series of laboratory tests.

INVESTIGATION OF CONCRETE PAVEMENT DESIGN

This investigation, which has for its object the development of information which will assist in a better understanding of the structural action of concrete pavement slabs and thus lead to improved structural design, has progressed toward its conclusion during the past year. A great many loading tests and other observations have been made and a considerable amount of new information of a definite and conclusive nature has been developed.

The series of reports, mentioned last year, by means of which this information will be made available, has been outlined in detail, and preparation of the reports has been started.

INVESTIGATIONS OF CONCRETE AND CONCRETE AGGREGATES

In previous reports reference has been made to investigations of pavement concrete which involved the construction and testing of full-size pavement slabs. These investigations have yielded valuable information regarding the effect of variations in materials and construction practices on the strength and uniformity of the concrete. The major conclusions from the first series of tests were given in the 1931 annual report. In the second series, the effect of using

high-speed vibrators mounted on the screeds of the finishing machine and the effect of delayed finishing for the purpose of removing excess water were studied. The portion of this investigation dealing with strength and uniformity has been completed and a report issued. The major conclusions were as follows:

EFFECT OF VIBRATION

By the use of vibrating equipment of the general type used in these tests it should be possible to place satisfactorily and to finish concrete considerably drier than is possible with methods now in common use.

For conditions comparable with these tests, it should be possible satisfactorily to place and finish by vibration concrete having a minimum slump of 1 inch as compared to a minimum slump of 2½ inches by methods now in common use.

These tests indicate that, depending on the type of coarse aggregate used, concrete containing from one fourth to three fourths parts more coarse aggregate than the base mix, if vibrated, should show as great uniformity and as high flexural strength as the base mix finished by methods now in common use. Such a mix will contain approximately from 0.2 to 0.6 sack of cement per cubic yard less than the base mix.

The indications of these tests are that the effect of vibration is more marked where angular coarse aggregates are used than where aggregates having rounded surfaces are used.

EFFECTS OF DELAYED FINISHING

The use of the method of delayed finishing as carried out in these tests will increase the density and strength of concrete pavement slabs, by eliminating, before final consolidation, a larger quantity of excess water than is accomplished by methods now in common use.

The application of the method of delayed finishing to a mix containing approximately one half part more fine and 1 part more coarse aggregate than the base mix will produce pavement slabs having substantially the same crushing and flexural strength as the base mix finished by methods now in common use. Such a mix will contain approximately one sack of cement per cubic yard of concrete less than the base mix.

In general, the indications of these tests are that the proper use of either the vibratory method of finishing or the method of delayed finishing should result in an improvement of the quality of concrete pavements. Tests are now under way to determine the effect of these special methods of finishing on the ultimate durability of the concrete as measured by freezing tests on cores cut from the test section.

OTHER CONCRETE TESTS

Several studies having to do with the general question of improving concrete in respect to its durability or resistance to weathering are being continued. In one series, a number of mortar specimens containing various types of concrete sand are being subjected to alternate freezing and thawing for the purpose of developing information which will make it possible to include in specifications definite quantitative requirements designed to insure durability of fine aggregates.

In an effort to improve existing methods of testing the wear-resisting qualities of coarse aggregates, a study was undertaken of the so-called "Los Angeles rattler" test used by the State of California. It has been claimed that this test is superior to the existing standard method because it is possible to test both crushed stone and gravel by the same method, thus eliminating the necessity for two separate specification requirements as at present. These tests were conducted in cooperation with the American Association of State Highway Officials, and a report is now being prepared for publication.

During the year an investigation was started which has for its major object the development of a standard laboratory procedure for testing the numerous new methods and materials continually being developed for curing concrete. Of these methods, one which presents interesting possibilities, not only as a means of curing but also as a means of insulation, involves the use of a cotton mat formed of one or more layers of raw cotton placed between sheets of cotton cloth. A laboratory study of this material showed quite definitely that the cotton mats were not only effective in providing insulation against the sun's rays but were also as efficient, from the standpoint of curing, as a double thickness of burlap kept wet 3 days. The results of this investigation have been published.

Attention has been called recently to the extreme importance of controlling the temperature and moisture content of concrete specimens at the time of test if reliable results are to be obtained. One series of tests, conducted for the purpose

of developing information along this line, has been completed and a report prepared. Another series involves tests, at various periods up to 1 year, of concrete containing both normal and lightweight aggregates stored and tested under both wet and dry conditions. These tests should also yield information of value as to the effect of artificial lightweight aggregates on the strength of concrete at different ages and under various curing conditions.

HIGHWAY BRIDGE INVESTIGATIONS

A complete report of the cooperative investigation of the Freyssinet method of arch construction as applied to the Rogue River bridge in Oregon has been completed and is being published as a bulletin of the Oregon Highway Commission.

A cooperative study of multiple-span reinforced-concrete arch bridges has been completed at the University of Illinois. This study was made for the purpose of determining the effect of spandrel structures of various types and elastic piers of various heights on the action of concrete arches. For this purpose several multiple-span arch ribs, each of three 26-foot spans, were built in the laboratory and deformation measurements made under loads of different intensities and distribution. The factors studied were spacing of expansion joints in the deck, height of deck above the rib at the crown, and height of elastic piers. Much information that will be useful to bridge designers was developed by this study. A complete report is now being compiled.

Tests to determine the friction developed in the sliding of expansion bearings of highway bridges, when the bearing plates are made of various materials and finished in different ways, were mentioned in last year's report. During the past year the schedule of tests has progressed steadily. Several hundred tests have been made, and an appreciable range in the coefficient of friction has been found to exist. The publication of the information obtained in this investigation should assist bridge engineers materially in designing sliding bearings.

MEASUREMENT OF ROAD SURFACE ROUGHNESS

Several years ago the Bureau developed a device, to be mounted on a motor vehicle, by which the successive deflections of the front springs of the vehicle, caused by the surface roughness of any road over which it might be driven, could be summed up and recorded in inches. The device was intended to indicate the relative roughness of road surfaces by the relative amounts of spring deflection recorded on different roads. There was full realization of its limitations, but it is useful nevertheless and has been used in many parts of the country. Its principal shortcoming is that the general level of the values recorded is affected by the vehicle characteristics (springs, weight, tire equipment, etc.), so that it is not possible satisfactorily to compare data obtained with the instrument mounted on different vehicles. This deficiency led to an investigation of the possibility of developing a standardized vehicle which could be used with the relative roughness indicator.

During the past year considerable study has been given to this problem. A single-wheel trailer has been built, capable of standardization in all of its parts, and the work done with it thus far gives promise that it may be satisfactory. It is relatively simple to build and can be readily attached to the rear bumper of any automobile.

With such a vehicle it should be possible to compare directly data taken with different units at widely separated points or to compare data taken from time to time with the same unit. If this becomes possible, the usefulness of the relative-roughness indicator will be greatly increased.

BITUMINOUS MATERIALS AND LOW-COST ROAD INVESTIGATIONS

The bituminous investigations of the Bureau, during the past year, have proceeded along the following lines: (1) Continued observations of experimental highways; (2) field surveys and related laboratory studies in connection with various types of low-cost roads; (3) development of provisional specifications for liquid asphaltic materials based on a standard simplified scheme of analysis; (4) laboratory investigations of bituminous materials and bituminous mixtures to aid in selecting suitable materials, and to develop satisfactory methods of design for special types of low-cost bituminous highway construction.

Of the experimental bituminous-treated roads which the Bureau has constructed and maintained in cooperation with the highway departments of South Carolina, Nebraska, and California, two projects, one in California and the other in South Carolina, have been discontinued, and final reports are being prepared. The Nebraska experiments, which are of mixed-in-place construction in the sand-hill areas, are being closely observed, and a report of the construction and behavior

of these sections is being prepared for publication. Periodic inspections of the bituminous surfacings on marl and sand-clay bases on the remaining project in South Carolina have been made during the past year, and the maintenance costs and behavior have been recorded.

The cooperation of the Bureau with representatives of the tar industry in field surveys of low-cost, tar-treated roads has been discontinued. The report of the survey of tar-treated roads in North Carolina has been published. A report of the observations of tar-bound roads in Pennsylvania is being prepared.

The cooperative effort of the Bureau, the State highway departments, and the asphalt industry to simplify the tests and standardize the specifications for liquid asphaltic road materials has resulted in the promulgation of provisional specifications for the principal grades of these materials. These proposed specifications have been considered by the cooperating agencies at a series of regional meetings, and they have been adopted in whole or in part by a large number of States for use in current construction. This important work will be continued in the hope of accomplishing Nation-wide standardization of specifications and test procedure for liquid asphaltic road materials.

Investigations to determine the weather-resisting properties of slow-curing liquid asphaltic materials from different refineries have been undertaken during the past year. This work is of importance since it is hoped that ultimately it will lead to the development of tests which will insure the durability of this type of bituminous material which is used extensively in low-cost surfaces. A progress report of the work to date has been prepared. Similar materials from other refineries, as well as liquid asphaltic materials of the rapid-curing type and tars from various producers, are to be studied during the coming year. The development of a satisfactory accelerated laboratory test, to supplement the tests more commonly used for the control of quality of liquid bituminous products, should aid greatly in securing longer life and greater durability of the materials.

Laboratory investigations to determine and evaluate the factors essential to the proper design of hot bituminous paving mixtures have been continued. These investigations involve tests of laboratory and field samples both with the Hubbard-Field stability apparatus and with the roller stability machine designed by the Bureau to simulate the action of traffic. A progress report is now being prepared.

There has recently been built for testing purposes a small circular test track having an outside diameter of 14 feet and a width of 18 inches. Facilities are provided for temperature control, and provisions are made for variations in the type and condition of the base. Traffic is applied to the test surface with full-sized rubber-tired automobile wheels. This permits the testing of low-cost bituminous surfaces under controlled conditions which are essentially comparable to those of actual service. To date, the effect of various quantities and consistencies of the bituminous material, in mats of the road-mixed or plant-mixed types, has been studied. As the work progresses, tests will be made to determine the relative importance of other factors influencing the stability and durability of the different types of low-cost bituminous surfaces, such as type of bituminous material, type and grading of mineral aggregate, and character and condition of the base.

SUBGRADE INVESTIGATIONS

During the past year the subgrade research work has been conducted principally along the following lines: (1) Simplification of the routine procedure for testing soils; (2) adaptation of the principle of the drainage indicator to a new device for use in testing topsoils in the field; (3) investigation of the relative efficiency of various preventive measures in common use for overcoming the detrimental effects of subgrade heaving due to frost; (4) investigation of the compression test of soils for practical use in connection with the design of foundations for bridges and other structures; and (5) development of new tests to disclose the properties of soils stabilized by chemical admixtures and other methods.

In the routine procedure for testing subgrade soils, described in Public Roads, vol. 12, nos. 4, 5, 7, and 8, there were included tests sufficient in number and sufficiently varied in character to identify all of the various soils likely to be encountered in a national highway-construction program and to allocate them to the proper subgrade group indicated by their physical characteristics.

Much of the soil testing is now performed for the purpose of determining the suitability of soil or soil material for some particular use as, for instance, binder in sand-clay and gravel roads, filler in bituminous road surfacing or soil in mud-jack operations; to distinguish between the good and the undesirable varieties of individual groups of surfacing materials such as limerock, caliche, shale, etc., and to identify the properties of various materials which, as admixtures, may assist in the stabilization of both subgrades and soil road surfaces.

Generally the efficiency of particular materials for the special uses just mentioned depends upon the presence of several of the half dozen or more physical characteristics investigated in the complete testing procedure. Therefore in the study of special materials, the testing procedure is limited to the use of those tests only which disclose the particular characteristics on which the performance of the special material depends.

Studies of this character consist of three distinct steps as follows: (1) Analysis of the requirements of the material for the use intended; (2) determination of the dominating characteristics satisfying these requirements; and (3) selection of the particular tests best suited to furnish the desired information with regard to these dominating characteristics.

The drainage indicator, developed to furnish the designer with tangible evidence of the drainage properties of soils, was referred to in last year's report. As a further utilization of the principles controlling tests with this apparatus a new device has been designed for field use. This device, termed "the combined soil tester", gives information as to permeability, capillarity, and stability of the soil sample. It was designed primarily for use in prospecting for topsoil and sand-clay road-surfacing materials.

As research has developed information with regard to the causes of frost heave, the locations where it is apt to occur, and possible methods of elimination, various preventive measures based on this information have been utilized in road construction. Comprehensive surveys in regions where frost heave is a serious problem have now been made to determine how well the preventive measures have performed their intended functions. The resulting information will serve as a basis for recommendations guiding the construction of roads where conditions indicate the possibility of frost heave.

Determination of the practical significance of the Terzaghi compression test as a means of disclosing the effect of proposed loads on the performance of soft undersoils resulted from a comprehensive investigation of the hydraulic fill at Four Mile Run on the Mount Vernon Memorial Highway. In this research settlements of the fill as determined by levels, and moisture contents of the soft undersoil as determined from samples in the laboratory, were compared with corresponding settlements and moisture contents as computed from data furnished by the compression test performed upon samples of soft undersoil in the undisturbed state. The agreement between computed and observed values seems substantial enough to warrant the conclusion that the settlement of soil layers in the field follows much the same laws that control the consolidation of small soil samples in the compression test in the laboratory.

In the design of new tests to disclose the suitability of low-cost road materials, an attempt is being made to arrange for the testing of the entire sample, including coarse, as well as fine material; for the preparation of the sample by bringing it into a state of consolidation similar to that attained by such materials when used in low-cost road construction; and for the testing of the sample directly for the properties on which the service of such materials depend.

In the current laboratory procedure the binder fraction, or that fraction passing the no. 40 sieve, is tested for several physical characteristics such as permeability, shrinkage, and water absorption. The mechanical analysis of the soil mortar, that fraction passing the no. 10 sieve, is determined. The coarse fraction, that retained on the no. 10 sieve, is tested for grading, hardness, etc. From the results of these three sets of tests an estimate is made of the value of the materials for the use intended.

These tests are satisfactory for fine-grained subgrade soil, but they do not satisfactorily indicate the properties of soils containing only a small percentage of fine particles. They are also inadequate in showing the effect of admixtures that may be incorporated in soils for stabilizing purposes and that may materially alter their properties. Investigation will be made of the suitability of tests in which the sample is mechanically consolidated to a density representative of that produced in a soil road surface by traffic.

In these tests the entire sample, including coarse fractions, is to be brought to a state of optimum consolidation, and then tested for permeability, capillarity, stability, and shrinkage.

Cooperation with the State highway departments in the making of subgrade surveys, in the design of the subgrade treatments and road surfaces, and in the establishment of subgrade soil laboratories, has continued as in past years.

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REPORT OF THE CHIEF OF THE BUREAU OF PUBLIC ROADS, 1934

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF PUBLIC ROADS,
Washington, D.C., September 1, 1934.

SIR: I submit herewith the report of the Bureau of Public Roads for the fiscal year ended June 30, 1934.

Respectfully,

THOMAS H. MACDONALD,
Chief.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

The work of road construction supervised by the Bureau of Public Roads during the fiscal year 1934 far exceeded in volume the work of any previous year. Augmenting balances of earlier appropriations available at the beginning of the year, the grants made under authority of the National Industrial Recovery Act contributed largely to a total fund for road construction under Federal auspices greater than any amount previously available at one time.

The work done has been subject to the provisions of various laws. In part it has consisted of Federal-aid road construction financed with joint Federal and State funds. In part it has been supplied with funds appropriated by the Emergency Relief and Construction Act of July 21, 1932; in part by funds made available by the National Industrial Recovery Act. The roads built have been sections of the Federal-aid highway system, extensions of the system into and through cities, important secondary or feeder roads, and sections of main highways through the national forests, parks, and public lands. The various appropriating acts have required the employment of different procedures; but regardless of class or location the common effect of all work done and, under existing conditions the most important, has been to increase employment.

EMPLOYMENT ON ROAD WORK

Congressional effort to increase employment through road work began with the act approved April 4, 1930, which, for the fiscal year 1931, increased the provision for Federal-aid road construction from $75,000,000, previously authorized, to $125,000,000, and authorized like appropriations for the fiscal years 1932 and 1933. This was followed by the act of December 20, 1930, which appropriated $80,000,000 to be advanced to the States for expenditure prior to September 1, 1931, and repayment by deduction from future apportionments of Federal aid, and this in turn by the Emergency Relief and Construction Act of July 21, 1932, which appropriated $120,000,000, also to be advanced and expended in a limited period with stipulation of repayment by deduction from future Federal-aid authorizations.

The two emergency appropriations were intended to meet what it was believed at the time would be a quickly passing difficulty of the States in matching Federal authorizations; hence the limited term of expenditure and the requirement of repayment by deduction from future Federal-aid apportionments.

A clearer recognition of the magnitude of the depression is indicated by the outright grant of enlarged amounts provided by the National Industrial Recovery Act, which next provided for road work; and a similar view is evident in the terms of the most recent act, approved June 18, 1934, which not only provides further outright grants, but also cancels the obligations created by the two emergency appropriations, and provides that no further deductions shall be made from future Federal-aid authorizations on account of the advances received by the States. This action was not taken, however, until one installment of the

U. S. GOVERNMENT PRINTING OFFICE

repayment required by the act of December 20, 1930, had been deducted from the Federal-aid apportionment for the fiscal year 1933.

Effects of all of these acts were present in the work of the past year; that of the act of December 20, 1930, slightly decreasing the funds available, and those of the other acts largely increasing the road-construction provision above the predepression level.

The result in terms of employment is shown by table 1. It will be noted that the employment on Federal and Federal-aid road construction supervised by the Bureau has increased materially each year since the fiscal year 1932, reaching in the last year a total of 2,120,761 man-months, an amount nearly equal to the combined total for the 2 preceding years.

TABLE 1.—*Comparison of employment during fiscal years 1932, 1933, and 1934 on all Federal and Federal-aid highway construction and on all Federal and State road work, including State maintenance operations, by months*

Month	Men employed on all Federal and Federal-aid highway construction			Total men employed on all Federal and State highway construction and maintenance		
	1932	1933	1934	1932	1933	
July	164,708	81,042	129,205	385,349	305,372	332,2..
August	151,418	89,346	111,211	389,949	333,403	329,813
September	116,100	122,193	115,047	356,617	374,405	337,973
October	88,869	124,106	154,016	330,104	373,246	384,029
November	62,466	129,933	185,860	289,316	371,667	420,069
December	35,991	98,271	174,358	244,971	290,465	362,031
January	29,518	75,498	154,154	229,189	266,443	315,989
February	26,673	78,215	156,814	218,218	255,256	306,090
March	28,008	95,704	144,053	211,549	279,213	296,265
April	42,205	122,256	187,657	245,843	299,882	345,278
May	59,008	139,831	271,972	259,615	330,138	466,504
June	71,772	152,276	336,414	280,636	359,605	545,013
Total (man-months)	876,736	1,308,671	2,120,761	3,441,356	3,839,095	4,441,331

The 1934 monthly employment, never lower than 111,211, the level of August 1933, before the stimulation of the National Industrial Recovery Act had been felt, reached in June 1934 a maximum of 336,414, when the new public works program was at its height. The average employment was 176,730 men throughout the year.

It is desired to stress the fact that these figures represent direct employment on the roads only and do not include the indirect employment provided in the production and transportation of materials and equipment used in the construction work. This indirect employment is conservatively estimated at 1.4 times the direct, or, for the year 1934, approximately 3,000,000 man-months.

It should also be explained that the figures reported represent continuous employment and not numbers of individual workers employed. A study of the pay rolls for the year indicates that the number of individuals given work in any month averages about four-tenths greater than the man-months of continuous employment. This is the result of the limit placed upon individual working hours. The 176,730 continuous employment average, therefore, represents an average of nearly 250,000 individuals directly employed throughout the year.

Referring again to table 1, it will be seen that the Federal and Federal-aid road construction employment supervised by the Bureau, has constituted an increasing proportion of the total employment afforded by all Federal and State highway construction and maintenance work since 1932. In that year the Federal work was approximately a fourth of the total program; in 1933 the proportion increased to about one-third; and in the fiscal year 1934 the work supervised by the Bureau employed nearly half of the total number of workers on all State and Federal projects including those employed on maintenance work by the States.

Table 2 gives details of the 1934 Federal and State employment by months, segregating the numbers of workers employed on the various classes of Federal and Federal-aid work supervised by the Bureau, and giving separately the numbers employed on independent State construction and maintenance. This table shows how the employment on Federal-aid projects and other work financed by the earlier appropriations—large at the beginning of the fiscal year—decreased from month to month, and how the work provided for by the several appropriations of the National Industrial Recovery Act developed monthly to maximum proportions at the end of the year.

TABLE 2.—*Employment during the fiscal year 1934 on the several classes of Federal and Federal-aid road construction and State road construction and maintenance*

Month	Employment on road construction													Employment on road maintenance by State highway departments	Total employment on Federal and State road construction and maintenance
	In whole or in part with Federal funds												With State funds only on State highways		
	Without Public Works funds				With Public Works funds, act of June 16, 1933										
					Under sec. 204 of act			Under sec. 205 of act			Under sec. 203 of act				
	National-forest highways	National-park highways	Public-land highways	Federal-aid highways	On Federal-aid system outside of municipalities	On extensions of Federal-aid system into municipalities	On secondary or feeder roads	National-forest highways	National-park highways	Public-lands highways	Loan-and-grant highways	National-work-relief highways			
July	7,466	2,193	591	118,953									61,428	141,644	332,277
August	7,698	2,916	244	96,335	3,080	720	218						60,365	158,237	329,813
September	6,353	2,879	416	70,516	20,447	2,592	6,338	561	125	25		4,795	62,366	160,560	337,973
October	4,637	2,333	314	49,795	55,983	9,465	20,948	1,917	1,069	82		7,473	58,711	171,302	384,029
November	2,635	959	320	34,372	78,674	15,962	37,677	2,771	1,599	218		10,673	63,379	170,830	420,069
December	1,099	154	154	20,112	69,423	16,448	43,475	3,229	1,872	415		17,977	46,810	140,863	362,031
January	300		72	7,452	61,217	13,000	42,592	1,966	1,413	316		25,826	25,345	136,490	315,989
February	273		60	2,316	62,754	17,077	40,544	1,825	1,519	480		29,966	22,311	126,965	306,090
March	456			1,040	61,887	21,106	34,509	2,134	1,035	560	670	20,656	19,985	132,227	296,265
April	756			1,476	81,843	36,164	43,188	3,700	2,601	946	3,456	13,527	21,510	136,111	345,278
May	1,195	63		2,969	117,045	57,920	63,020	5,129	3,671	1,109	5,101	14,750	27,161	167,371	466,504
June	1,371	316		3,205	132,252	77,566	80,082	6,494	4,437	1,123	8,321	21,147	37,642	170,957	545,013

In consonance with the paramount employment motive of the Recovery Act the rules and regulations imposed a number of conditions upon the expenditure of the public works appropriations which had the effect of increasing the amount of human employment per unit of expenditure, of increasing the numbers of individuals employed, and of distributing the benefits of the expenditure widely and in approximate relation to the employment need.

Wherever practicable and consistent with sound economy and public advantage it was required that work be done by human labor instead of machinery. This was accomplished by means of special provisions requiring hand labor, which were attached to the specifications governing the work. But, in thus requiring the substitution of human labor for mechanical means on certain classes of work, there was studied effort to avoid so great an abandonment of machine methods as would seriously jeopardize the highly efficient and important road-machinery industry.

By the approval of varied types of improvement a desirable balance was maintained between the volume of direct labor afforded at the site of the work and the volume of indirect employment afforded at the material and equipment plants and in the transport industries. On work of the lower types, which was encouraged on the secondary and feeder roads where traffic density would permit, the direct local employment formed a large part of the total. In the higher types of improvement, approved for main rural roads and streets in cities, the element of indirect employment is greater.

By requiring a reasonable minimum of expenditure on extensions of the Federal-aid highway system across cities, opportunities for work were held out to the city unemployed. By imposing a similar requirement necessitating use of a portion of the funds for construction of secondary or feeder roads a volume of work particularly fitted for large local employment was insured.

The limits imposed on the hours of work to be allowed to individuals had the effect of increasing the number of individuals employed, and effort was made to compensate the individual for reduction of his hours of work by increasing his hourly wage. This was done by requiring the establishment by the several State highway departments of minimum rates of wage sufficient to provide, for the hours of labor as limited and in consideration of other existing conditions, a standard of living in decency and comfort.

In the employment of labor the services of local agencies of the Federal Employment Service were invariably utilized, and the several preferences required by the act were closely observed.

The rules and regulations, issued with the approval of the Special Board for Public Works, required that road-building projects should be provided in not less than 75 percent of the counties of each State. As shown by table 3, this desirable degree of diffusion of the employment opportunity was realized and exceeded in the work undertaken up to the end of the fiscal year. In 2,649 counties, or 86 percent of the total number in the United States, some employment was provided by the highway construction funds appropriated by the National Industrial Recovery Act.

TABLE 3.—*Number of counties in which Public Works highway projects have been undertaken to June 30, 1934, by States*

State	Total counties	Counties in which projects have been undertaken		State	Total counties	Counties in which projects have been undertaken	
	Number	*Number*	*Percent*		*Number*	*Number*	*Percent*
Alabama	67	63	94	New Hampshire	10	10	100
Arizona	14	13	93	New Jersey	21	20	95
Arkansas	75	63	84	New Mexico	31	30	97
California	58	49	84	New York	62	54	87
Colorado	63	57	90	North Carolina	100	86	86
Connecticut	8	6	75	North Dakota	53	53	100
Delaware	3	3	100	Ohio	88	87	99
Florida	67	55	82	Oklahoma	77	76	99
Georgia	159	99	62	Oregon	36	34	94
Idaho	44	32	73	Pennsylvania	67	67	100
Illinois	102	93	91	Rhode Island	5	5	100
Indiana	92	63	68	South Carolina	46	46	100
Iowa	99	91	92	South Dakota	69	61	88
Kansas	105	98	93	Tennessee	95	68	72
Kentucky	120	100	83	Texas	254	229	90
Louisiana	64	49	77	Utah	29	28	97
Maine	16	16	100	Vermont	14	13	93
Maryland	23	23	100	Virginia	100	79	79
Massachusetts	14	11	79	Washington	39	31	79
Michigan	83	83	100	West Virginia	55	45	82
Minnesota	87	78	90	Wisconsin	71	70	99
Mississippi	82	61	74	Wyoming	23	23	100
Missouri	114	87	76	Hawaii	4	4	100
Montana	56	52	93				
Nebraska	93	70	75	Total	3,074	2,649	86
Nevada	17	15	88				

CLASSES OF WORK SUPERVISED BY THE BUREAU

The road-construction work supervised by the Bureau during the fiscal year was of several classes, supported by funds appropriated by a number of different acts.

A diminishing portion of the program was provided for by the unexpended balances of Federal-aid appropriations authorized over a period of years ended with the fiscal year 1933.

A portion that rapidly increased as the year grew older was financed with funds appropriated by the National Industrial Recovery Act for improvements on the Federal-aid highway system and its municipal extensions and on secondary or feeder roads.

These were the larger classes of work. Smaller in total volume, more restricted in location, but nevertheless locally important were three other classes, embracing the improvement of national-forest highways, national-park highways, and highways through the public lands of the United States. Of these the first and third were under the sole administration of the Department. The national-park highways were constructed with appropriations made to the Interior Department, but under an interdepartmental agreement were supervised by the Bureau. All three classes were supported at the beginning of the year mainly by earlier appropriations, with increasing support from appropriations made by the National Industrial Recovery Act as the year progressed.

Two other classes of work developed during the year—both as outgrowths of the recovery legislation. First was the work-relief construction which was begun in the fall of 1933 as a means of providing quick and specialized relief in a number of States in which unemployment conditions were particularly acute. On this work the Bureau with the cooperation of the State highway departments acted only to supervise the construction. The workers were selected and paid by the Federal Emergency Relief Administration, and funds necessary to meet expenses of material and equipment were provided by special grants made by the Public Works Administration.

The other new class consisted of projects financed under the loan-and-grant provisions of the National Industrial Recovery Act, which after approval by the Public Works Administration were, late in the year, placed by that body under the supervision of the Bureau.

In addition to the several classes mentioned above, the year's work included only an inconsiderable volume of improvement under several appropriations for the reconstruction of roads damaged by floods in several States.

The year's activities in respect to each of these classes of work are reported separately hereafter.

STATUS OF MAJOR APPROPRIATIONS

The greater part of the Bureau's work during the year was supported by appropriations of three general types, as follows:

(1) Federal-aid appropriations made under authorizations for fiscal years up to 1933. These appropriations must be matched with State or other funds, and when so matched are available for expenditure only on the approved Federal-aid highway system.

(2) The appropriation made by the Emergency Relief and Construction Act of 1932. This appropriation was available to the States to be used, in lieu of State funds, for the purpose of matching Federal-aid appropriations. It could also be used in conjunction with funds appropriated by the National Industrial Recovery Act. The availability of this money originally terminated on July 1, 1933, but was extended by later legislation to September 1, 1934.

(3) The appropriation made by section 204 of the National Industrial Recovery Act for improvement of the Federal-aid system and its municipal extensions and secondary or feeder roads. This money is available for payment of the whole cost of improvements except expenses for right-of-way, but may be used in conjunction with either Federal-aid or emergency-construction funds or both.

FEDERAL-AID FUNDS

No funds of this character were authorized for the fiscal year 1934. In 3 years from 1931 to 1933, inclusive, they were authorized at the rate of $125,000,000 a year but the last authorization was subject to reduction in the amount of one-fifth of the amount actually expended of the emergency funds provided by the act of December 20, 1930. The amount so deducted was $15,840,743.86.

Table 4 gives for the fiscal years 1923 to 1933, inclusive, the amounts of the Federal-aid funds apportioned among the States after deducting the percentage allowable for Federal administration, and, for the same period of years with addition of 1934, the amounts obligated to definite projects and amounts paid for work done during each of the years. It will be observed that the maximum rate of obligation and expenditure of these funds was reached in the fiscal year 1931, with recession in later years as the unobligated and unexpended balances were reduced and other funds became available. As shown by this table the amount of Federal-aid funds paid to the States in the fiscal year 1934 was $42,291,937.

TABLE 4.—*Federal-aid funds apportioned to the States, obligated to projects and paid to the States each fiscal year, 1923 to 1934, inclusive*

Fiscal year	Apportioned amount of appropriation authorized for the year	Amount of Federal-aid funds obligated during the year	Amount of Federal-aid funds paid to States during the year
1923	$48,750,000.00	$77,461,559	$69,677,241.86
1924	63,375,000.00	89,866,864	79,217,397.90
1925	73,125,000.00	87,294,396	95,749,998.11
1926	73,125,000.00	79,608,897	87,754,534.57
1927	73,125,000.00	77,453,046	81,371,013.03
1928	73,125,000.00	88,922,185	80,802,232.55
1929	73,125,000.00	70,428,896	82,097,380.38
1930	73,125,000.00	102,498,084	75,880,862.84
1931	121,875,000.00	157,952,903	133,340,910.64
1932	121,875,000.00	83,793,787	127,367,119.74
1933	106,034,256.14	46,689,026	101,266,331.02
1934		12,847,071	42,291,936.73
Total	900,659,256.14	974,816.714	1,056,816,959.37
Average	[1] 81,878,114.19	81,234,726	88,068,079.95

[1] Average for 11 years. No Federal-aid funds were authorized for fiscal year 1934.

Details of this expenditure are given by States in table 5, which also shows the status of the unexpended funds at the close of the fiscal year. It will be noted that only $2,343,260 of the authorized funds were at that time unobligated. Unpaid there was a balance of $16,815,933; but of this sum a portion was already earned by the completion of work for which it was allotted, and the unearned balance was only approximately $10,211,000 at the end of the year.

TABLE 5.—*Federal aid paid to States during the fiscal year 1934, and unpaid, unearned, and unobligated balances of the total Federal-aid apportionment on June 30, 1934*

State	Paid to States	Unpaid balance	Unearned balance	Unobligated balance
Alabama	$2,324,634.14	$2,043,129.04	$1,592,000	$351,115.15
Arizona	560,394.49	59,784.04	38,000	33,103.61
Arkansas	1,494,124.06	648,415.99	545,000	75,129.29
California	655,553.02	36,786.21	3,000	1,821.49
Colorado	925,237.45	211,472.94	42,000	27,377.17
Connecticut	515,624.60	474,321.96	254,000	9,178.67
Delaware	201,522.96	5,270.48	5,000	2,312.20
Florida	1,695,063.72	394,337.30	197,000	7,447.41
Georgia	391,954.97	184,458.57	153,000	152,218.29
Idaho	337,566.03	102,711.87	70,000	59,268.92
Illinois	1,774,923.47	865,402.93	462,000	54,521.60
Indiana	819,805.79	288,186.55	110,000	
Iowa	264,678.43			
Kansas	703,004.64	113,490.85	114,000	113,490.85
Kentucky	889,745.76	42,503.66	19,000	13,361.92
Louisiana	1,086,896.48	251,354.15	168,000	
Maine	267,431.91	172.41		172.41
Maryland	108,541.13	6,123.96		
Massachusetts	872,096.37	369,103.41	132,000	9,264.56
Michigan	1,267,149.36	168,815.75	28,000	7,434.87
Minnesota	200,482.17	177,918.47	40,000	
Mississippi	2,505,921.08	2,087,731.39	1,600,000	259,765.82
Missouri	537,918.16	131,801.96	124,000	105,362.40
Montana	1,425,177.35	463,904.52	315,000	
Nebraska	607,433.39	151,237.92	140,000	5,804.68
Nevada	387,267.79	43,327.07	43,000	
New Hampshire	224,716.03	46,441.90	28,000	20,454.57
New Jersey	1,182,237.99	813,121.49	167,000	32,005.49
New Mexico	475,389.13	167,928.32	80,000	
New York	3,021,672.54	1,197,343.64	468,000	36,138.40
North Carolina	1,448,914.13	816,152.24	714,000	140,296.10
North Dakota	1,032,699.12	747,829.63	467,000	65,982.52
Ohio	931,300.25	252,357.07	150,000	133,911.36
Oklahoma	909,018.25	197,510.08	133,000	129,886.18
Oregon	712,204.38	284,343.34	248,000	6,519.97
Pennsylvania	1,426,678.37	159,148.20	29,000	29,027.84
Rhode Island	191,834.72	62,867.28	25,000	62,867.28
South Carolina	275,562.48	105,320.77	34,000	27,749.78
South Dakota	360,972.48	555,054.74	365,000	34,633.42
Tennessee	1,263,315.71	217,824.10	104,000	14,771.08
Texas	2,752,059.57	296,136.07	124,000	73,364.70
Utah	318,341.01	249,712.46	100,000	100,228.86
Vermont	59,010.26	6,553.48	6,000	
Virginia	605,451.05	608,934.50	226,000	111,246.83
Washington	424,495.23	16,168.04	1,000	
West Virginia	374,055.40	75,175.40	36,000	32,197.59
Wisconsin	515,271.05	66,490.14	40,000	
Wyoming	277,718.07	143,272.61	75,000	
Hawaii	688,870.79	408,484.58	397,000	3,827.16
Total	42,291,936.73	16,815,933.48	10,211,000	2,343,260.44

By act approved June 18, 1934, additional Federal-aid appropriations were authorized to be made in the amount of $125,000,000 for each of the fiscal years 1936 and 1937. In accordance with the requirements of the Federal Highway Act, as amended, the first of these sums will be apportioned on or before January 1, 1935.

EMERGENCY CONSTRUCTION FUNDS

The amount appropriated by the Emergency Relief and Construction Act of 1932 was $120,000,000. The entire sum, without deduction for Federal administrative purposes, was apportioned among the several States and Hawaii as shown by table 6. These sums have since been expended in conjunction with

Federal-aid apportionments and apportionments under the Recovery Act, the total expenditure to June 30, 1934, being $117,801,106, as also detailed in table 6. Of the total payments to that date the table shows that $55,669,145 was expended during the fiscal year 1934. The unexpended balance on June 30 was $2,198,893, which under the law is available for expenditure until September 1, 1934.

TABLE 6.—*Emergency construction apportionment, and amounts paid to States for the fiscal year 1934, and the total paid to June 30, 1934*

State	Emergency construction apportionment	Paid to States during fiscal year	Total paid to States
Alabama	$2,558,229	$995,831.15	$2,459,481.88
Arizona	1,760,771	532,825.26	1,760,771.00
Arkansas	2,101,182	1,103,914.48	1,902,477.37
California	4,667,188	1,270,621.86	4,667,188.00
Colorado	2,258,613	1,074,298.69	2,252,465.93
Connecticut	778,806	579,504.01	778,806.00
Delaware	600,000	600,000.00	600,000.00
Florida	1,624,752	606,598.97	1,606,492.36
Georgia	3,123,298	739,944.03	3,123,298.00
Idaho	1,505,912	703,613.01	1,463,572.47
Illinois	5,082,847	3,668,754.15	5,047,271.14
Indiana	3,058,980	3,058,980.00	3,058,980.00
Iowa	3,171,504	767,516.02	3,171,504.00
Kansas	3,265,048	1,200,149.43	3,265,048.00
Kentucky	2,264,637	1,299,458,60	2,264,637.00
Louisiana	1,745,559	587,089.44	1,745,559.00
Maine	1,067,079	677,062.94	1,067,079.00
Maryland	1,019,570	584,762.73	1,012,258.46
Massachusetts	1,716,612	949,563.31	1,716,612.00
Michigan	3,779,706	1,943,559.90	3,741,758.47
Minnesota	3,368,559	1,632,238.28	3,368,559.00
Mississippi	2,160,164	1,451,997.95	2,110,277.21
Missouri	3,753,453	2,182,531.78	3,753,453.00
Montana	2,525,071	887,899.75	2,525,070.99
Nebraska	2,544,773	468,687.55	2,544,773.00
Nevada	1,575,756	616,058.23	1,575,756.00
New Hampshire	600,000	359,347.65	585,770.91
New Jersey	1,657,733	266,812.33	1,126,499.65
New Mexico	1,965,473	296,123.13	1,965,473.00
New York	6,059,238	3,376,356.51	5,903,568.85
North Carolina	2,888,251	1,221,832.19	2,850,691.40
North Dakota	1,933,901	1,059,858.72	1,933,747.45
Ohio	4,490,175	2,281,141.54	4,360,381.66
Oklahoma	2,888,723	1,677,905.78	2,862,675.87
Oregon	2,001,740	947,972.47	1,894,260.81
Pennsylvania	5,267,060	3,017,822.63	5,267,060.00
Rhode Island	600,000	211,931.96	600,000.00
South Carolina	1,666,755	515,460.11	1,578,281.29
South Dakota	2,004,573	729,537.73	1,947,289.39
Tennessee	2,605,160	808,775.44	2,550,438.58
Texas	7,664,621	4,295,592.53	7,664,621.00
Utah	1,395,331	640,265.91	1,268,956.02
Vermont	600,000	341,655.44	600,000.00
Virginia	2,256,178	784,024,62	1,947,710.38
Washington	1,920,470	713,579.38	1,920,470.00
West Virginia	1,323,912	399,990.56	1,269,388.54
Wisconsin	2,991,076	983,531.22	2,986,704.18
Wyoming	1,541,561	456,621.02	1,541,561.00
Hawaii	600,000	99,544.95	592,407.32
Total	120,000,000	55,669,145.34	117,801,106.58

The act of December 20, 1930, which appropriated $80,000,000 to be advanced for emergency construction provided for the repayment of amounts actually expended by deduction in five equal installments from future Federal-aid authorizations beginning with that for the fiscal year 1933. The first deduction was made, as previously reported, in the amount of $15,840,743.86.

The Emergency Relief and Construction Act provided for repayment of its $120,000,000 appropriation in similar manner over a period of 10 years, commencing with the fiscal year 1938.

Both of these repayment requirements were rescinded by the act approved June 18, 1934, in accordance with which no further deductions will be made on account of the advances made.

PUBLIC WORKS HIGHWAY FUNDS

By section 204 of the National Industrial Recovery Act the President was authorized to make grants to the highway departments of the several States in an amount not less than $400,000,000, to be expended by such departments in general accord with the provisions of the Federal Highway Act with certain exceptions.

By direction of the President the amount of $400,000,000 was allotted for the purpose named by the Public Works Administration for apportionment among the 48 States and the District of Columbia and Hawaii, as required by the act.

After deduction of 1½ percent for Federal administration the balance of $394,000,000 was apportioned in the manner required by the act of June 16, 1933. Seven-eighths of the total was apportioned, as required in the manner prescribed for Federal-aid authorizations, i.e., three equal parts each were divided according to the area, population, and post-road mileage of the participating governmental units; and one-eighth was divided in proportion to population. The resulting apportionment is given in table 7.

TABLE 7.—*Apportionment and assignment of Public Works highway funds, June 30, 1934, as provided by sec. 204 of the National Industrial Recovery Act*

State	Apportionment	Assignment of apportioned funds—					
		To projects on the Federal-aid system outside of municipalities		To projects on extensions of the Federal-aid system into and through municipalities		To projects on secondary or feeder roads	
		Amount	Percent	Amount	Percent	Amount	Percent
Alabama	$8,370,133	$4,185,067.00	50.0	$2,092,533.00	25.0	$2,092,533.00	25.0
Arizona	5,211,960	3,878,555.11	74.0	807,982.36	16.0	525,422.53	10.0
Arkansas	6,748,335	3,374,167.00	50.0	1,889,534.00	28.0	1,484,634.00	22.0
California	15,607,354	7,803,677.00	50.0	4,213,986.00	27.0	3,589,691.00	23.0
Colorado	6,874,530	3,437,265.00	50.0	1,718,633.00	25.0	1,718,632.00	25.0
Connecticut	2,865,740	1,404,213.00	49.0	802,407.00	28.0	659,120.00	23.0
Delaware	1,819,088	909,544.00	50.0	454,772.00	25.0	454,772.00	25.0
Florida	5,231,834	2,615,917.00	50.0	1,307,959.00	25.0	1,307,958.00	25.0
Georgia	10,091,185	5,045,592.00	50.0	2,724,620.00	27.0	2,320,973.00	23.0
Idaho	4,486,249	2,166,858.00	48.3	1,197,829.00	26.7	1,121,562.00	25.0
Illinois	17,570,770	4,585,971.00	26.1	7,718,839.00	43.9	5,265,960.00	30.0
Indiana	10,037,843	5,018,921.00	50.0	4,416,651.00	44.0	602,271.00	6.0
Iowa	10,055,660	5,027,830.00	50.0	2,815,585.00	28.0	2,212,245.00	22.0
Kansas	10,089,604	5,044,802.00	50.0	2,522,401.00	25.0	2,522,401.00	25.0
Kentucky	7,517,359	3,608,332.00	48.0	2,029,687.00	27.0	1,879,340.00	25.0
Louisiana	5,828,591	2,914,295.00	50.0	1,457,148.00	25.0	1,457,148.00	25.0
Maine	3,369,917	1,617,560.00	48.0	909,878.00	27.0	842,479.00	25.0
Maryland	3,564,527	1,782,263.00	50.0	891,132.00	25.0	891,132.00	25.0
Massachusetts	6,597,100	1,101,716.00	16.7	5,007,199.00	75.9	488,185.00	7.4
Michigan	12,736,227	6,113,389.00	48.0	3,438,781.00	27.0	3,184,057.00	25.0
Minnesota	10,656,569	4,561,011.00	42.8	3,719,143.00	34.9	2,376,415.00	22.3
Mississippi	6,978,675	3,489,337.00	50.0	1,744,669.00	25.0	1,744,669.00	25.0
Missouri	12,180,306	5,237,532.00	43.0	4,019,501.00	33.0	2,923,273.00	24.0
Montana	7,439,748	4,463,849.00	60.0	1,115,962.00	15.0	1,859,937.00	25.0
Nebraska	7,828,961	3,914,481.00	50.0	1,957,240.00	25.0	1,957,240.00	25.0
Nevada	4,545,917	2,909,387.00	64.0	500,051.00	11.0	1,136,479.00	25.0
New Hampshire	1,909,839	725,739.00	38.0	706,640.00	37.0	477,460.00	25.0
New Jersey	6,346,039	3,099,370.48	48.8	3,190,118.00	50.3	56,550.52	.9
New Mexico	5,792,935	2,896,467.00	50.0	1,448,234.00	25.0	1,448,234.00	25.0
New York	22,330,101	10,271,846.00	46.0	8,449,487.00	37.8	3,608,768.00	16.2
North Carolina	9,522,293	4,761,147.00	50.0	2,380,573.00	25.0	2,380,573.00	25.0
North Dakota	5,804,448	2,902,224.00	50.0	1,451,112.00	25.0	1,451,112.00	25.0
Ohio	15,484,592	7,277,758.00	47.0	4,335,686.00	28.0	3,871,148.00	25.0
Oklahoma	9,216,798	4,608,399.00	50.0	2,304,200.00	25.0	2,304,199.00	25.0
Oregon	6,106,896	3,053,448.00	50.0	1,526,724.00	25.0	1,526,724.00	25.0
Pennsylvania	18,891,004	6,691,194.00	35.4	4,854,988.00	25.7	7,344,822.00	38.9
Rhode Island	1,998,708	999,354.00	50.0	499,677.00	25.0	499,677.00	25.0
South Carolina	5,459,165	2,729,583.00	50.0	1,364,791.00	25.0	1,364,791.00	25.0
South Dakota	6,011,479	3,005,739.00	50.0	1,502,870.00	25.0	1,502,870.00	25.0
Tennessee	8,492,619	4,246,309.00	50.0	2,123,155.00	25.0	2,123,155.00	25.0
Texas	24,244,024	12,122,012.00	50.0	6,061,006.00	25.0	6,061,006.00	25.0
Utah	4,194,708	2,374,205.00	56.6	771,826.00	18.4	1,048,677.00	25.0
Vermont	1,867,573	928,184.00	49.7	500,509.00	26.8	438,880.00	23.5
Virginia	7,416,757	3,708,379.00	50.0	2,008,458.00	27.1	1,699,920.00	22.9
Washington	6,115,867	3,057,934.00	50.0	1,977,260.00	32.3	1,080,673.00	17.7
West Virginia	4,474,234	2,013,405.00	45.0	1,342,270.00	30.0	1,118,559.00	25.0
Wisconsin	9,724,881	4,615,429.00	47.5	2,684,067.00	27.6	2,425,385.00	24.9
Wyoming	4,501,327	2,250,663.00	50.0	1,125,332.00	25.0	1,125,332.00	25.0
District of Columbia	1,918,469			959,235.00	50.0	959,234.00	50.0
Hawaii	1,871,062	1,683,956.00	90.0			187,106.00	10.0
Total	394,000,000	186,234,275.59	47.3	115,042,340.36	29.2	92,723,384.05	23.5

The rules and regulations, issued by the Secretary of Agriculture with approval of the Special Board for Public Works on June 23, 1933, required that not more than 50 percent of the funds apportioned to any State should be applied to projects on the Federal-aid system outside of the corporate limits of municipalities, and not less than 25 percent to projects on extensions of the Federal-aid system into and through municipalities, the balance (not more than 25 percent) to be applied to secondary or feeder roads, all subject to certain exceptions as might be required by existing conditions.

Each State highway department was required at the outset to submit a preliminary statement of the proposed assignment to the three classes of projects, conforming to the above requirements, and, as promptly as possible thereafter, to submit for approval a program in detail of the locations of projects to be developed with the amounts tentatively to be allotted to each. The assignments as approved are also shown in table 7.

The assignments approved, programs were submitted and approved without undue delay, and the definite obligation of the money to planned projects proceeded rapidly. On June 30, 1934, there remained only $26,606,762 unobligated as shown by table 8, and the amounts obligated were divided among the three classes of projects in the several States as shown.

TABLE 8.—*Status of obligation of apportioned Public Works highway funds, June 30, 1934*

State	Total apportionment	Obligated to projects—			Balance unobligated
		On the Federal-aid system outside of municipalities	On extensions of the Federal-aid system into and through municipalities	On secondary or feeder roads	
Alabama	$8,370,133	$3,703,255.35	$2,021,073.79	$1,844,514.68	$801,289.18
Arizona	5,211,960	3,849,592.80	762,925.76	520,199.36	79,242.08
Arkansas	6,748,335	3,165,249.95	1,785,803.10	1,125,572.99	671,708.96
California	15,607,354	7,794,571.70	4,170,374.60	3,370,187.46	272,220.24
Colorado	6,874,530	3,427,087.02	1,647,302.57	1,690,915.51	109,224.90
Connecticut	2,865,740	1,399,781.88	801,335.26	659,120.00	5,502.86
Delaware	1,819,088	895,682.01	418,154.71	254,337.50	250,913.78
Florida	5,231,834	2,474,109.07	1,307,959.00	1,276,269.83	173,496.10
Georgia	10,091,185	4,150,027.70	1,569,042.30	1,267,603.09	3,104,511.91
Idaho	4,486,249	2,062,955.10	1,131,268.94	1,121,562.00	170,462.96
Illinois	17,570,770	4,526,063.09	7,545,903.54	5,265,960.00	232,843.37
Indiana	10,037,843	5,018,921.00	4,018,041.37	540,734.86	460,145.77
Iowa	10,055,660	5,008,455.50	2,169,419.50	2,212,245.00	665,540.00
Kansas	10,089,604	5,044,802.00	2,522,401.00	2,522,401.00	
Kentucky	7,517,359	3,608,332.00	1,313,825.58	1,869,467.43	725,733.99
Louisiana	5,828,591	2,671,632.13	1,457,148.00	1,282,354.88	417,455.99
Maine	3,369,917	1,503,746.86	830,956.22	832,924.50	202,289.42
Maryland	3,564,527	1,253,345.03	386,588.31	848,166.20	1,076,427.46
Massachusetts	6,597,100	1,020,088.06	4,760,414.75	469,741.41	346,855.78
Michigan	12,736,227	5,810,696.00	3,330,370.00	3,069,700.00	525,461.00
Minnesota	10,656,569	4,561,011.00	3,116,986.64	2,180,092.88	798,478.48
Mississippi	6,978,675	2,921,629.97	1,051,512.55	1,247,149.80	1,758,382.68
Missouri	12,180,306	4,997,772.36	3,405,062.84	2,861,843.14	915,627.66
Montana	7,439,748	4,460,575.17	1,108,927.26	1,859,101.96	11,143.61
Nebraska	7,828,961	3,913,681.39	1,937,151.64	1,954,539.51	23,588.46
Nevada	4,545,917	2,829,544.63	458,967.14	1,008,029.88	249,375.35
New Hampshire	1,909,839	646,720.06	706,640.00	477,383.82	79,095.12
New Jersey	6,346,039	2,730,945.88	2,928,244.38	56,550.52	630,298.22
New Mexico	5,792,935	2,835,862.97	1,348,276.16	1,246,115.17	362,680.70
New York	22,330,101	10,217,884.12	7,781,926.87	3,598,271.33	732,018.68
North Carolina	9,522,293	4,165,843.62	1,833,496.43	1,851,173.75	1,671,779.20
North Dakota	5,804,448	2,835,758.70	1,151,825.47	727,957.69	1,088,906.14
Ohio	15,484,592	7,241,144.63	4,329,185.88	3,820,428.00	93,833.49
Oklahoma	9,216,798	4,315,911.77	2,081,894.67	2,276,385.92	542,605.64
Oregon	6,106,896	3,044,966.08	1,415,326.54	1,526,724.00	119,879.38
Pennsylvania	18,891,004	6,627,677.96	4,265,313.83	7,247,292.79	750,719.42
Rhode Island	1,998,708	996,029.70	499,677.00	412,465.02	90,536.28
South Carolina	5,459,165	2,444,212.87	1,124,097.85	1,364,791.00	526,063.28
South Dakota	6,011,479	2,752,531.80	1,143,740.66	1,021,899.41	1,093,307.13
Tennessee	8,492,619	4,124,026.04	1,863,450.28	1,934,210.23	570,932.45
Texas	24,244,024	10,710,542.07	5,212,530.13	5,620,455.24	2,700,496.56
Utah	4,194,708	2,295,679.72	657,221.88	1,018,704.93	223,101.47
Vermont	1,867,573	912,174.61	500,509.00	438,880.00	16,009.39
Virginia	7,416,757	3,471,555.25	1,861,920.03	1,652,964.06	430,317.66
Washington	6,115,867	3,040,009.78	1,960,021.92	1,073,983.31	41,851.99
West Virginia	4,474,234	1,945,733.43	1,201,103.25	1,046,755.17	280,642.15
Wisconsin	9,724,881	4,578,428.21	2,487,464.62	2,295,740.74	363,247.43
Wyoming	4,501,327	2,229,816.75	1,012,380.87	1,125,332.00	133,797.38
District of Columbia	1,918,469		953,096.04	959,028.70	6,344.26
Hawaii	1,871,062	1,682,967.22		177,717.69	10,377.09
Total	394,000,000	177,919,032.01	103,348,260.13	86,125,945.36	26,606,762.50

The amounts paid to the several States for work done under the Recovery Act appropriation are given in table 9. These amounts do not include $35,275,000 advanced to 32 States, the District of Columbia, and Hawaii to provide revolving funds for direct payment of amounts due for work done, nor do they include amounts due for work completed in other States for which at the time the Federal Government had not made reimbursement.

TABLE 9.—*Amounts paid to the States from Public Works highway funds provided by section 204 of the National Industrial Recovery Act, to June 30, 1934*

State	Amount	State	Amount	State	Amount
Alabama	$1,897,468.23	Massachusetts	$1,478,810.68	Rhode Island	$538,181.34
Arizona	2,588,102.48	Michigan	2,924,506.92	South Carolina	1,557,411.43
Arkansas	1,674,465.29	Minnesota	3,937,230.10	South Dakota	1,345,689.59
California	4,570,381.71	Mississippi	1,333,164.99	Tennessee	2,692,653.22
Colorado	3,217,748.86	Missouri	4,476,949.44	Texas	9,258,492.53
Connecticut	763,678.42	Montana	3,443,719.02	Utah	2,362,403.72
Delaware	406,303.82	Nebraska	3,270,749.41	Vermont	485,450.45
Florida	2,983,546.61	Nevada	2,120,654.76	Virginia	1,557,676.29
Georgia	2,851,850.61	New Hampshire	535,010.21	Washington	2,747,160.15
Idaho	1,859,379.43	New Jersey	1,313,467.55	West Virginia	1,611,570.57
Illinois	2,280,937.40	New Mexico	2,247,289.75	Wisconsin	2,858,737.46
Indiana	1,185,655.28	New York	5,321,487.84	Wyoming	1,569,632.58
Iowa	4,015,611.46	North Carolina	2,565,598.68	Hawaii	361,946.00
Kansas	5,462,560.14	North Dakota	1,148,440.28	District of Columbia	846,671.08
Kentucky	3,136,992.52	Ohio	5,251,474.89		
Louisiana	1,662,460.54	Oklahoma	3,674,089.52		
Maine	1,441,460.71	Oregon	2,324,174.84	Total	[1] 123,754,297.00
Maryland	495,358.56	Pennsylvania	4,099,839.64		

[1] In addition, $35,275,000 had been advanced to 32 States, the District of Columbia, and Hawaii to provide revolving funds from which payments are made directly.

By the Hayden-Cartwright Act, approved June 18, 1934, there was authorized to be appropriated $200,000,000 to be apportioned and otherwise administered in a manner similar to but not exactly like the $400,000,000 fund granted by the Recovery Act. This sum was apportioned on June 19, 1934, as shown in table 10, and at the end of the fiscal year further progress toward expenditure of the money awaited issuance of the rules and regulations.

TABLE 10.—*Apportionment of Public Works highway appropriation authorized by the act of June 18, 1934*

State	Amount	State	Amount	State	Amount
Alabama	$4,259,842	Massachusetts	$3,350,474	Rhode Island	$1,014,572
Arizona	2,641,935	Michigan	6,452,568	South Carolina	2,770,954
Arkansas	3,428,049	Minnesota	5,425,551	South Dakota	3,047,643
California	7,932,206	Mississippi	3,540,227	Tennessee	4,302,991
Colorado	3,486,006	Missouri	6,173,740	Texas	12,291,253
Connecticut	1,454,868	Montana	3,769,734	Utah	2,132,691
Delaware	923,395	Nebraska	3,964,364	Vermont	948,007
Florida	2,661,343	Nevada	2,302,356	Virginia	3,765,387
Georgia	5,113,491	New Hampshire	969,462	Washington	3,106,412
Idaho	2,277,486	New Jersey	3,220,879	West Virginia	2,280,335
Illinois	8,921,401	New Mexico	2,941,700	Wisconsin	4,941,837
Indiana	5,088,963	New York	11,327,921	Wyoming	2,287,712
Iowa	5,118,361	North Carolina	4,840,941	District of Columbia	973,842
Kansas	5,117,675	North Dakota	2,938,967	Hawaii	949,778
Kentucky	3,818,311	Ohio	7,865,012		
Louisiana	2,963,932	Oklahoma	4,685,180	Total	200,000,000
Maine	1,711,586	Oregon	3,097,814		
Maryland	1,810,058	Pennsylvania	9,590,788		

PROGRESS IN FEDERAL-AID ROAD CONSTRUCTION

Although the expenditure of Federal-aid road funds was far less during the year 1934 than in any other recent year, the largest portion of the mileage on which construction was completed during the year was that built under the Federal-aid plan. The large completion was due to the fact that many projects approved under the Federal-aid apportionments were far advanced when the year began and the small expenditure was due to the fact that the near approach to obligation of all apportioned funds cut off the development of new projects to replace those completed.

Initial Federal-aid improvements were made during the fiscal year on 9,192.3 miles of the Federal-aid highway system; advanced stages of improvement were constructed on 5,583.6 miles; and 4.3 miles previously improved were reconstructed. The total Federal-aid construction completed was therefore 14,780.2 miles. The result of the year's work in this single class of activity was greater than the whole mileage improved during the preceding year, which was 13,255.3 miles, and was exceeded only by the mileage improved in the fiscal year 1932.

The improvements classed as completed and included in the above mileage figures are not only physically completed but have also been paid for by the Federal Government to the full extent of its obligation.

The distribution of the completed mileage by States, its total cost, and the Federal-aid involved are shown in table 11. For the country as a whole, the total cost was $237,972,675 of which $84,592,580 was paid from Federal-aid funds and the balance from Federal emergency and State funds.

TABLE 11.—*Total cost, Federal aid, and mileage of Federal-aid roads, initial and stage construction, and reconstruction completed and paid for during the fiscal year 1934*

State	Total cost	Federal aid	Mileage		
			Initial	Stage	Total
Alabama	$3,482,092.33	$1,720,016.26	120.3	55.2	175.5
Arizona	3,670,947.12	1,746,922.45	94.9	250.9	345.8
Arkansas	4,941,959.54	2,349,176.78	153.6	115.1	268.7
California	7,877,209.25	1,840,782.69	153.0	34.4	187.4
Colorado	4,666,410.98	2,155,405.48	181.3	125.7	307.0
Connecticut	1,661,827.34	673,119.47	32.9	7.2	40.1
Delaware	811,533.07	178,968.52	30.9	14.4	45.3
Florida	5,282,492.80	2,382,797.19	130.7	14.4	145.1
Georgia	4,815,820.88	1,837,986.16	116.3	198.1	314.4
Idaho	2,159,567.85	761,075.68	90.1	148.8	238.9
Illinois	12,820,215.21	4,217,703.01	406.4	48.8	455.2
Indiana	6,623,398.08	2,125,386.18	314.2	30.9	345.1
Iowa	5,053,779.35	862,583.58	253.1	66.8	319.9
Kansas	4,959,012.02	1,510,076.50	294.1	181.2	475.3
Kentucky	5,486,233.06	1,908,812.10	189.6	175.5	365.1
Louisiana	4,844,155.95	2,041,903.02	38.8	34.4	73.2
Maine	2,399,342.03	667,599.68	70.2	2.5	72.7
Maryland	1,739,445.09	358,958.61	66.9	1.5	68.4
Massachusetts	4,088,522.85	1,252,601.31	47.6		47.6
Michigan	7,861,473.23	2,888,473.88	310.5	107.7	418.2
Minnesota	6,471,799.78	1,064,307.73	213.7	200.2	413.9
Mississippi	3,047,926.43	1,462,623.00	104.0	79.0	183.0
Missouri	4,499,358.53	801,780.41	214.5	31.1	245.6
Montana	4,992,163.37	2,795,391.22	383.9	312.6	696.5
Nebraska	6,317,474.80	2,896,730.18	183.8	166.3	350.1
Nevada	3,105,090.55	1,306,233.41	94.3	272.7	367.0
New Hampshire	957,756.11	379,664.74	22.8	3.4	26.2
New Jersey	4,041,116.02	1,369,305.81	39.7	.3	40.0
New Mexico	4,618,731.38	2,048,371.47	275.4	155.6	431.0
New York	12,779,829.99	4,076,917.97	333.8	36.4	370.2
North Carolina	5,235,750.65	2,519,493.79	601.6	35.2	636.8
North Dakota	3,560,912.11	1,346,546.63	401.4	734.9	1,136.3
Ohio	8,247,547.28	2,276,698.32	201.6	68.4	270.0
Oklahoma	6,422,142.63	2,254,905.50	377.8	81.2	459.0
Oregon	4,315,366.78	1,606,011.70	109.5	102.4	211.9
Pennsylvania	11,491,797.67	3,728,345.46	348.2	14.1	362.3
Rhode Island	1,053,589.24	325,973.76	22.5	[1] 4.5	27.0
South Carolina	1,990,019.56	745,108.25	77.9	87.6	165.5
South Dakota	2,773,970.34	961,978.11	226.8	320.6	547.4
Tennessee	4,561,824.34	2,179,750.25	147.9	51.8	199.7
Texas	19,089,447.91	6,831,199.02	684.8	707.4	1,392.2
Utah	2,141,122.41	917,916.87	152.8	117.2	270.0
Vermont	669,158.92	87,446.51	29.7	6.5	36.2
Virginia	3,391,055.49	1,480,123.24	159.7	56.0	215.7
Washington	3,592,792.73	1,115,686.14	122.2	16.5	138.7
West Virginia	2,672,830.24	1,123,570.00	97.3	8.2	105.5
Wisconsin	5,854,771.57	1,458,331.96	159.6	106.7	266.3
Wyoming	2,968,770.48	913,848.98	262.4	197.6	460.0
Hawaii	1,863,119.46	1,037,971.22	47.3		47.3
Total	237,972,674.80	84,592,580.20	9,192.3	5,587.9	14,780.2

[1] Includes 4.3 miles of reconstruction.

The classification of the completed mileage by types of surface improvement is shown in table 12.

TABLE 12.—*Mileage of Federal-aid roads, by types of construction, completed and final payment made, during the fiscal year 1934*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Totals		
		Untreated	Treated	Untreated	Treated	Untreated	Treated							Initial	Stage	Total
Alabama	74.6							9.4		14.4	75.8		1.3	120.3	55.2	175.5
Arizona	26.5			87.9				228.7					2.7	94.9	250.9	345.8
Arkansas	37.4			27.6	36.7			26.1			139.6		1.3	153.6	115.1	268.7
California	17.2			4.3				63.9		32.5	63.7		5.8	153.0	34.4	187.4
Colorado	7.6			161.4				96.9		1.2	31.8		8.1	181.3	125.7	307.0
Connecticut				8.6					6.9		23.5		1.1	32.9	7.2	40.1
Delaware	2.4									.6	42.3			30.9	14.4	45.3
Florida	55.4						43.9			5.2	33.4		7.2	130.7	14.4	145.1
Georgia	55.8		18.8		34.9		100.4	5.5		15.9	81.5		1.6	116.3	198.1	314.4
Idaho				94.7				143.0					1.2	90.1	148.8	238.9
Illinois	29.2										420.6		5.4	406.4	48.8	455.2
Indiana	39.3										305.8			314.2	30.9	345.1
Iowa	30.2			116.3							172.3		1.1	253.1	66.8	319.9
Kansas	161.3	129.0		18.9				135.9	.3		26.6		3.3	294.1	181.2	475.3
Kentucky	113.3			93.4				12.4		26.6	118.2		1.2	189.6	175.5	365.1
Louisiana	5.3			1.5							63.8		2.6	38.8	34.4	73.2
Maine					27.8				14.2		29.8		.9	70.2	2.5	72.7
Maryland	4.3			6.1					23.3	12.3	22.2		.2	66.9	1.5	68.4
Massachusetts									12.7	6.5	27.0		1.4	47.6		47.6
Michigan	107.0			52.5				5.8		22.7	229.4		.8	310.5	107.7	418.2
Minnesota	192.3			6.6							215.0			213.7	200.2	413.9
Mississippi	97.2									8.7	75.5		1.6	104.0	79.0	183.0
Missouri	30.4			89.7							123.9		1.6	214.5	31.1	245.6
Montana	122.4			371.7				200.0					2.4	383.9	312.6	696.5
Nebraska	121.9	46.0						62.5			113.8		5.9	183.8	166.3	350.1
Nevada				141.5				213.7		5.4	5.0		1.4	94.3	272.7	367.0
New Hampshire							9.1		1.8		14.9		.4	22.8	3.4	26.2
New Jersey	3.7								.1		34.6		1.6	39.7	.3	40.0
New Mexico	44.1			176.8	15.0			178.0		9.2	3.6		4.3	275.4	155.6	431.0
New York	43.3			10.8	6.2			.9	14.3	36.2	256.6	1.1	.8	333.8	36.4	370.2
North Carolina	28.8	141.1	103.3	110.9	72.4	49.7	18.0	88.2		20.7	1.2		2.5	601.6	35.2	636.8
North Dakota	432.8			544.0				149.3		1.4	8.0		.8	401.4	734.9	1,136.3
Ohio	7.3			1.6		.2	1.2		.4	77.6	136.3	40.2	5.2	201.6	68.4	270.0
Oklahoma	323.7										131.4		3.9	377.8	81.2	459.0
Oregon	63.3			63.4	4.3	4.8	8.9	1.2	38.4	6.2	19.3		2.1	109.5	102.4	211.9
Pennsylvania	26.4			3.2		142.9	16.8			24.0	147.1		1.9	348.2	14.1	362.3
Rhode Island									11.9	3.3	11.7		.1	22.5	4.5	27.0
South Carolina			93.5		25.3						46.3		.4	77.9	87.6	165.5
South Dakota	183.0			248.4				93.1			22.5		.4	226.8	320.6	547.4
Tennessee	60.3									46.9	90.0		2.5	147.9	51.8	199.7
Texas	489.0			98.7	210.0		104.8			46.5	431.4	3.1	8.7	684.8	707.4	1,392.2
Utah	1.3			175.2				77.6		3.8	11.0		1.1	152.8	117.2	270.0

TABLE 12.—*Mileage of Federal-aid roads, by types of construction, completed and final payment made, during the fiscal year 1934*—Con.

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Totals		
		Untreated	Treated	Untreated	Treated	Untreated	Treated							Initial	Stage	Total
Vermont				19.3				16.0			.1		.8	29.7	6.5	36.2
Virginia	40.8	61.6		9.4		63.6	4.5			11.1	23.6		1.1	159.7	56.0	215.7
Washington	11.9			117.3							8.5		1.0	122.2	16.5	138.7
West Virginia	55.6				.5		19.1				29.9		.4	97.3	8.2	105.5
Wisconsin	48.1			23.2							193.1		1.9	159.6	106.7	266.3
Wyoming	203.5			137.5				117.5					1.5	262.4	197.6	460.0
Hawaii						1.9			45.1				.3	47.3		47.3
Total	3,397.9	377.7	215.6	3,022.4	433.1	263.1	326.7	1,925.6	169.4	438.9	4,061.6	44.4	103.8	9,192.3	5,587.9	14,780.2

In addition to the projects completed and paid for, there were others on which at the end of the year all construction work was completed to the satisfaction of the Bureau, as determined by final inspection, and only the final payment by the Federal Government remained to be made before classifying them as completed. In this report these projects are classified with those under construction and approved for construction at the close of the year.

Together, the projects in these three stages, representing the active Federal-aid improvement program at the end of the year, involved only 2,920.6 miles, as compared with a total of 16,481.3 miles the previous year. The large decrease is the result of the near approach to complete obligation of the available Federal-aid funds.

Of the total of 2,920.9 miles in the current program at the end of the year 2,054.2 miles were in course of initial improvement and 866.7 miles were in course of stage construction active or planned.

The distribution, by States, of the Federal-aid mileage in the three stages of progress toward completion is shown in table 13, together with estimated total costs and the amounts of Federal aid allotted. As in the case of the completed projects the difference between the total cost and the Federal aid will be supplied from Federal emergency-construction funds and State funds. For the country as a whole, the estimated cost of the projects in progress toward completion at the end of the year was $77,147,811; the Federal aid allotted, $31,525,545.

TABLE 13.—*Total cost, Federal aid, and mileage of Federal-aid roads, initial and stage improvement, finally inspected, under construction and approved for construction, June 30, 1934* [1]

State	Estimated total cost	Federal aid allotted	Mileage		
			Initial	Stage	Total
Alabama	$2,454,570.98	$1,227,320.42	38.1	64.8	102.9
Arizona	268,627.34	218,523.09	2.2	8.7	10.9
Arkansas	1,642,344.71	784,865.87	97.0	36.9	133.9
California	1,660,884.60	459,033.28	25.5	3.4	28.9
Colorado	1,279,941.78	630,203.93	56.9	5.6	62.5
Connecticut	2,592,964.59	1,059,366.62	13.8		13.8
Delaware	138,879.50	25,512.72		7.2	7.2
Florida	2,434,960.51	1,134,981.14	62.2		62.2
Georgia	836,784.27	283,492.29	31.5	19.1	50.6
Idaho	841,099.57	293,196.85	21.5	48.0	69.5
Illinois	9,055,119.93	4,031,115.14	246.7	22.6	269.3
Indiana	4,698,920.96	2,068,678.36	100.6	.8	101.4
Kentucky	425,699.14	170,746.35	7.6	16.4	24.0
Louisiana	2,487,790.47	1,176,664.98	7.8	.4	8.2
Maryland	155,884.65	20,284.20	2.5		2.5
Massachusetts	3,460,290.04	770,604.17	46.7	4.9	51.6
Michigan	2,208,873.05	922,230.00	84.5	24.8	109.3
Minnesota	2,433,519.01	837,447.31	43.8	53.3	97.1
Mississippi	5,006,100.00	2,496,082.83	130.3	108.7	239.0
Missouri	307,318.26	73,274.28	3.3		3.3
Montana	1,659,836.98	921,663.27	84.3	75.7	160.0
Nebraska	273,047.54	134,200.56		6.1	6.1
New Hampshire	210,985.67	75,692.99	2.5	2.2	4.7
New Jersey	2,937,392.79	908,098.69	28.1		28.1
New Mexico	47,997.80	23,998.90	.2		.2
New York	6,841,839.60	2,250,655.00	185.3	3.1	188.4
North Carolina	430,742.98	221,757.73	29.5		29.5
North Dakota	1,139,400.00	561,797.08	24.3	37.7	62.0
Ohio	1,397,810.00	284,369.55	14.0		14.0
Oklahoma	1,595,488.10	730,253.20	58.3	26.7	85.0
Oregon	724,371.08	330,945.45	14.3	18.5	32.8
Pennsylvania	2,459,609.53	699,447.05	82.3		82.3
South Carolina	1,752,527.54	661,593.99	84.4	79.1	163.5
South Dakota	636,255.57	333,547.32	71.8	25.9	97.7
Tennessee	1,154,501.80	575,824.91	24.7	19.5	44.2
Texas	2,451,977.26	975,130.76	74.1	48.6	122.7
Utah	1,183,396.65	542,563.03	43.6	59.7	103.3
Vermont	32,523.66	3,429.60	1.4		1.4
Virginia	2,869,150.19	1,311,752.06	126.5	25.5	152.0
Washington	507,644.68	84,810.39	5.4		5.4
West Virginia	1,131,772.11	432,682.77	42.1		42.1
Wisconsin	53,938.65	4,000.00	1.3		1.3
Wyoming	134,314.83	64,000.00	6.2	12.8	19.0
Hawaii	1,130,712.54	709,706.82	27.1		27.1
Total	77,147,810.91	31,525,544.95	2,054.2	866.7	2,920.9

[1] No mileage in this status in Iowa, Kansas, Maine, Nevada, and Rhode Island.

The classification of the projects in the active program by types of surface improvement is shown in table 14.

TABLE 14.—*Mileage of Federal-aid roads, by types of construction, initial and stage, finally inspected, under construction and approved for construction June 30, 1934* [1]

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total		
		Untreated	Treated	Untreated	Treated	Untreated	Treated							Initial	Stage	Total
Alabama	0.4						1.6	27.6		23.8	32.1		17.4	38.1	64.8	102.9
Arizona	.4							8.7			1.8			2.2	8.7	10.9
Arkansas	12.7			27.9				72.9			20.4			97.0	36.9	133.9
California	13.8				6.3					5.4	3.4			25.5	3.4	28.9
Colorado				47.0				14.7					.8	56.9	5.6	62.5
Connecticut									12.8		1.0			13.8		13.8
Delaware	7.2														7.2	7.2
Florida	42.0										20.2			62.2		62.2
Georgia	24.9										25.6		.1	31.5	19.1	50.6
Idaho				24.9				44.5					.1	21.5	48.0	69.5
Illinois	18.1										251.2			246.7	22.6	269.3
Indiana	4.6									61.2	35.6			100.6	.8	101.4
Kentucky	7.0										16.4		.6	7.6	16.4	24.0
Louisiana	5.3			1.2							.4		1.3	7.8	.4	8.2
Maryland				2.4									.1	2.5		2.5
Massachusetts								3.6	48.0					46.7	4.9	51.6
Michigan	9.1			19.6						53.4	27.2			84.5	24.8	109.3
Minnesota											97.1			43.8	53.3	97.1
Mississippi	104.1		9.3	4.4						62.5	58.7			130.3	108.7	239.0
Missouri				2.8									.5	3.3		3.3
Montana	18.0			22.0				119.6					.4	84.3	75.7	160.0
Nebraska											6.1				6.1	6.1
New Hampshire							.7		1.7		2.3			2.5	2.2	4.7
New Jersey	8.0										20.0		.1	28.1		28.1
New Mexico													.2	.2		.2
New York	18.0			57.7					70.4	39.1	3.2			185.3	3.1	188.4
North Carolina				15.7		13.7					.1			29.5		29.5
North Dakota	31.9			.8	10.7			17.9					.7	24.3	37.7	62.0
Ohio					1.3					12.7				14.0		14.0
Oklahoma	42.1										42.9			58.3	26.7	85.0
Oregon									12.1	20.7				14.3	18.5	32.8
Pennsylvania						37.0				45.3				82.3		82.3
South Carolina		18.1	124.2		3.5						17.5		.2	84.4	79.1	163.5
South Dakota	29.2			42.5				25.9					.1	71.8	25.9	97.7
Tennessee	22.6									7.8	13.4		.4	24.7	19.5	44.2
Texas	53.2			7.1	11.6		5.8		6.2		37.5		1.3	74.1	48.6	122.7
Utah				11.9				88.1			3.3			43.6	59.7	103.3
Vermont	.5			.7							.2			1.4		1.4

Virginia	76.1	.7		2.0		52.2				11.5	9.5			126.5	25.5	152.0
Washington	5.4													5.4		5.4
West Virginia	33.7			3.1			5.2						.1	42.1		42.1
Wisconsin											1.3			1.3		1.3
Wyoming	6.2							12.8						6.2	12.8	19.0
Hawaii									27.1					27.1		27.1
Total	594.5	18.8	133.5	293.7	33.4	102.9	13.3	436.3	178.3	343.4	748.4		24.4	2,054.2	866.7	2,920.9

[1] No projects in this status in Iowa, Kansas, Maine, Nevada, and Rhode Island.

87528—34——3

The total mileage, improved with Federal aid from the inauguration of the policy in 1916 to the end of the fiscal year was 119,712 miles. As explained in previous annual reports this total does not include mileage improved but since reduced or eliminated by relocations, mileage initially improved but currently undergoing stage construction and other mileage off the Federal-aid system for which substitutions on the system have been made.

Table 15 shows in parallel columns the mileage by States included in the designated Federal-aid highway system and the mileage improved with Federal aid to June 30, 1934. The total mileage in the system was 207,231; and, as the table shows, more than half of it has been improved with Federal aid.

TABLE 15.—*Mileage of designated Federal-aid highway system, in each State, and mileage improved with Federal aid to June 30, 1934*

State	Mileage of designated Federal-aid highway system	Mileage improved with Federal aid to June 30, 1934	State	Mileage of designated Federal-aid highway system	Mileage improved with Federal aid to June 30, 1934
Alabama	3,933	2,585.6	New Hampshire	988	460.5
Arizona	1,979	1,452.0	New Jersey	1,447	683.0
Arkansas	4,953	2,198.8	New Mexico	3,678	2,523.8
California	5,214	2,703.3	New York	8,118	3,922.0
Colorado	3,659	2,017.1	North Carolina	5,735	2,940.7
Connecticut	1,019	330.9	North Dakota	7,420	6,082.7
Delaware	754	413.6	Ohio	5,914	3,290.0
Florida	2,478	787.7	Oklahoma	6,049	2,806.8
Georgia	5,610	3,518.2	Oregon	3,795	1,802.3
Idaho	3,265	1,778.1	Pennsylvania	7,132	3,638.8
Illinois	7,498	3,568.1	Rhode Island	493	298.7
Indiana	4,930	2,369.4	South Carolina	3,545	2,258.4
Iowa	7,405	3,831.5	South Dakota	6,289	4,762.2
Kansas	7,920	4,305.1	Tennessee	3,982	1,925.1
Kentucky	3,701	2,190.9	Texas	12,513	9,136.1
Louisiana	2,742	1,673.3	Utah	1,787	1,474.5
Maine	1,588	889.4	Vermont	1,036	421.3
Maryland	2,177	912.2	Virginia	3,851	2,223.7
Massachusetts	1,504	935.0	Washington	3,177	1,449.3
Michigan	5,259	2,719.3	West Virginia	2,223	1,046.2
Minnesota	6,895	4,595.3	Wisconsin	5,557	3,002.3
Mississippi	3,709	2,095.1	Wyoming	3,565	2,496.6
Missouri	7,432	3,441.0	Hawaii	532	141.2
Montana	5,510	3,491.6			
Nebraska	5,594	4,580.0	Total	207,231	119,712.4
Nevada	1,677	1,543.7			

Classification of the 119,712 miles of completed federally aided roads as of June 30, by States and by types of surface improvement is shown in table 16.

TABLE 16.—*Mileage of Federal-aid roads, improved, by types of construction, by States, June 30, 1934*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							
Alabama	260.8	490.0		899.6	4.5		16.3	37.0	62.8	173.2	610.1		31.3	2,585.6
Arizona	24.7	29.9		379.9				854.5	.8	38.9	110.7		12.6	1,452.0
Arkansas	98.5			922.0	36.7	41.1	87.4	49.3		266.0	677.7		20.1	2,198.8
California	435.5			456.3		31.4		503.1	110.1	344.5	795.4		27.0	2,703.3
Colorado	184.6	47.5		874.5		88.3		336.6		15.6	439.9		30.1	2,017.1
Connecticut				8.8		17.2	.1		49.6	.6	247.6		7.0	330.9
Delaware	2.4			30.3				11.7		6.0	355.5	6.2	1.5	413.6
Florida	56.1	15.5			1.0	85.4	156.3		72.6	84.3	292.0	10.2	14.3	787.7
Georgia	316.1	798.8	18.8	383.5	34.9	52.3	413.4	38.5	226.9	133.8	1,067.7	3.0	30.5	3,518.2
Idaho	176.7			647.7		157.7		626.9	20.3	92.7	49.0		7.1	1,778.1
Illinois	153.7			.4					3.4	3.2	3,360.7	31.6	15.1	3,568.1
Indiana	42.6			90.2					17.0	12.0	2,193.3	6.6	7.7	2,369.4
Iowa	1,136.3			542.4							2,127.2	22.0	3.6	3,831.5
Kansas	1,173.1	709.6		329.9	115.1			608.5	129.9	10.7	1,036.8	164.5	27.0	4,305.1
Kentucky	603.4			502.2		16.2	50.3	38.1	84.3	234.4	649.8	3.9	8.3	2,190.9
Louisiana	68.6			1,275.3					3.2	41.8	264.5		19.9	1,673.3
Maine				236.4	191.5				240.8		216.4		4.3	889.4
Maryland	9.2			45.0		.2	3.9		272.2	67.8	512.9		1.0	912.2
Massachusetts				.4	.4	.2	2.8	22.3	528.1	80.2	289.4		11.2	935.0
Michigan	161.0			395.7			16.3	5.8	5.4	163.6	1,964.2	.4	6.9	2,719.3
Minnesota	1,201.7	11.1		1,497.5	17.7					32.7	1,831.5		3.1	4,595.3
Mississippi	394.8	15.0	9.3	1,143.5		11.1				83.6	411.9	9.5	16.4	2,095.1
Missouri	429.1			836.2		19.6			27.4	20.0	2,083.5	7.5	17.7	3,441.0
Montana	259.7			2,453.3				713.7		13.1	37.4		14.4	3,491.6
Nebraska	474.4	3,267.1	6.6					165.8		14.6	613.6	19.5	18.4	4,580.0
Nevada	25.5			460.0	10.1			989.0	5.0	30.3	21.5		2.3	1,543.7
New Hampshire					.2	91.7	96.9		89.9	31.9	144.2		5.7	460.5
New Jersey	23.3			6.0			.2		.9	22.5	624.5		5.6	683.0
New Mexico	256.7	19.1		1,665.3	15.0			451.0		9.9	93.2		13.6	2,523.8
New York	109.5			129.1	6.2			.9	475.5	190.6	3,005.5	1.8	2.9	3,922.0
North Carolina	107.5	593.7	129.8	244.0	102.3	84.4	21.8	229.3	35.3	308.8	1,073.3		10.5	2,940.7
North Dakota	753.9	.3		4,874.5	129.1			286.2		2.6	26.1		10.0	6,082.7
Ohio	134.0			52.4		105.4	27.3		373.0	217.3	1,635.4	715.1	30.1	3,290.0
Oklahoma	828.5	.6		511.2	8.3	28.8			.6	151.0	1,248.0	8.9	20.9	2,806.8
Oregon	374.5			801.4	34.7	47.7	51.1	17.6	276.8	64.7	122.5		11.3	1,802.3
Pennsylvania	195.0			3.1		616.0	27.4		7.7	162.1	2,576.3	43.4	7.8	3,638.8
Rhode Island	5.8						1.8		106.3	49.3	132.3		3.2	298.7
South Carolina	52.8	892.3	217.8	101.0	28.7				.3	185.0	755.6		24.9	2,258.4
South Dakota	281.4	34.0		3,985.2	46.1			232.9		4.9	170.0		7.7	4,762.2
Tennessee	241.3			106.2		61.4			341.8	273.2	888.0		13.2	1,925.1
Texas	1,246.7	21.1		2,671.1	657.9	69.0	328.4		519.6	856.1	2,669.1	32.8	64.3	9,136.1

TABLE 16.—*Mileage of Federal-aid roads, improved, by types of construction, by States, June 30, 1934*—Continued

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							
Utah	98.9			440.1	7.4	270.7		502.0	4.5	18.2	128.1		4.6	1,474.5
Vermont				128.2	2.0	1.1		32.2	61.2		188.6		8.0	421.3
Virginia	262.4	400.3	13.7	118.4	5.2	386.5	46.0		386.2	63.5	527.4		12.1	2,223.7
Washington	256.0			693.9							491.5		7.9	1,449.3
West Virginia	340.3			33.7	.5	19.5	25.9	1.4	200.1	28.1	382.5	10.3	3.9	1,046.2
Wisconsin	215.4	19.0		892.3	15.8				13.8	.4	1,833.4		12.2	3,002.3
Wyoming	532.7	10.2		1,269.3				631.5	1.7	22.1	17.4		11.7	2,496.6
Hawaii						1.9			105.5	13.3	19.0		1.5	141.2
Total	14,007.1	7,375.1	396.0	33,137.4	1,471.3	2,304.8	1,373.6	7,385.8	4,860.5	4,639.1	41,012.1	1,097.2	652.4	119,712.4

CHANGES IN THE FEDERAL-AID HIGHWAY SYSTEM

In the last annual report the mileage of the Federal-aid system within the boundaries of national forests, Indian reservations, and other Federal reservations was reported as 6,224 miles, as determined up to the close of the fiscal year 1933. During the past year this mileage has been increased to 6,262 miles by the addition to the system of new routes in several States, portions of which lie within the various kinds of reservations. The added mileage was actually 14 miles greater than the difference between the two annual totals, because of the fact that the mileage in Oregon was reduced by that amount, from 495 to 481 miles. The location, by States, of the mileage within Federal reservations is shown in table 17.

TABLE 17.—*Mileage of Federal-aid highway system within Federal reservations, being the amounts by which the 7-percent limiting mileage may be exceeded in each State as of June 30, 1934*

State	Mileage within Federal reservations	State	Mileage within Federal reservations	State	Mileage within Federal reservations
Arizona	547	Minnesota	75	Pennsylvania	108
Arkansas	120	Mississippi	10	South Dakota	477
California	465	Montana	1,069	Tennessee	66
Colorado	438	Nebraska	21	Utah	103
Georgia	58	Nevada	22	Virginia	49
Idaho	558	New Hampshire	33	Washington	440
Illinois	5	New Mexico	368	West Virginia	29
Iowa	2	New York	16	Wisconsin	46
Kansas	15	North Carolina	176	Wyoming	326
Kentucky	6	North Dakota	23		
Maine	5	Oklahoma	48	Total	6,262
Michigan	57	Oregon	[1] 481		

[1] Due to more accurate measurements and relocations there is a reduction of 14 miles from the previous figure.

By amendment of the Federal Highway Act, approved May 21, 1928, the original 7-percent system may be increased by those mileages within Federal reservations, and such addition, together with an increase in the mileage of the system in Hawaii authorized by a special act approved February 23, 1931, raises the permissible mileage of the initial system to 207,143 miles.

The permissible Federal-aid-system mileage has been further increased by additions to the initial 7-percent mileage in States where provision has been made for the completion and maintenance of 90 percent of the original system, as provided by the Emergency Relief and Construction Act of 1932. Such extensions have been made in Connecticut, Delaware, Florida, Illinois, Maryland, Massachusetts, Nevada, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, and Virginia; amounting in the 14 States to 10,644 miles. The total permissible mileage of the Federal-aid system, as of June 30, 1934, was raised by this further addition to 217,787 miles. As shown in table 15, the amount actually designated and approved by the Secretary of Agriculture up to June 30, was 207,231 miles.

PROGRESS IN PUBLIC WORKS HIGHWAY CONSTRUCTION

The National Industrial Recovery Act contained a provision authorizing grants to be made in amount not less than $400,000,000 to be expended in general accordance with the Federal Highway Act for improvement of roads included in the Federal-aid highway system and extensions thereof into and through municipalities and for improvement of secondary or feeder roads.

The allotment for this purpose was made through the Special Board for Public Works on June 22, 1933, and the allotted funds were apportioned by the Secretary of Agriculture with the approval of the special board on June 23. Rules and regulations to govern the expenditure of the money were issued on the same day, and the preliminary work of submission and approval of programs was accomplished as rapidly as was to be expected in view of the existing circumstances.

Work on the first project to be approved was begun in Utah on August 5 and thereafter the beginning of work followed rapidly in all States. In the course

of the year construction was begun on 20,660 miles of road and completed on 6,986 miles, leaving 13,674 miles under construction on June 30, 1934. On the same date projects approved for construction included 1,718 miles, so that there was included in the year's active program a total of 22,378 miles.

The total cost of the projects completed during the year was $79,774,036. The estimated total cost of the projects under construction at the close of the year was $283,506,260; and that of the projects approved for construction at the same time was $36,312,064, making a total for the year's active program of $399,592,360.

Of the 6,986 miles in completed projects 4,363 miles was located on the Federal-aid highway system outside of municipalities. The improvement of this mileage cost $46,283,443, of which $41,194,237 was paid from Public Works funds, $2,499,221 from Federal-aid funds and the remainder from Federal emergency construction and State funds.

Four hundred and sixty-nine miles, costing $17,297,070 was on extensions of the Federal-aid system into and through municipalities. Of the total cost of this mileage the Public Works funds provided $16,707,715 and Federal-aid funds $145,863, the balance from the other above-mentioned sources.

The remaining completed mileage—2,154 miles costing $16,193,523—consisted of secondary and feeder roads. The cost of these was met to the extent of $15,300,038 from Public Works funds and the balance was paid from State funds. Federal-aid and emergency-construction funds were not available for this portion of the work because the roads improved are in no case included in the Federal-aid system.

The distribution, by States, of the completed mileage in each of the three classes of projects is given in table 18, together with the total costs of the roads built and the amounts paid from Public Works and Federal-aid funds.

TABLE 18.—*Total cost and mileage of Public Works highway projects completed to June 30, 1934, and Federal funds allotted thereto, by States*

PROJECTS ON THE FEDERAL-AID SYSTEM OUTSIDE OF MUNICIPALITIES [1]

State	Total cost	Federal funds allotted		Mileage
		Public Works funds	Federal-aid funds	
Alabama	$1,596,441.15	$880,571.63	$715,869.52	61.9
Arizona	1,776,203.88	1,735,542.70		131.1
Arkansas	299,964.82	200,126.94	99,837.88	9.5
California	3,837,155.68	2,954,376.75		142.5
Colorado	1,514,031.69	1,500,790.30		96.0
Connecticut	31,798.76	31,798.76		.1
Delaware	192,063.14	191,170.71		3.0
Florida	1,281,060.88	814,074.82	466,986.06	43.7
Georgia	1,232,521.05	1,232,521.05		73.6
Idaho	824,604.86	809,780.19		81.8
Illinois	50,872.54	50,872.54		.9
Iowa	1,057,700.42	1,038,800.00		74.5
Kansas	1,330,234.56	1,329,365.58		206.5
Kentucky	554,103.01	549,646.72		59.6
Louisiana	222,415.49	222,390.49		9.7
Massachusetts	289,573.84	212,377.94	69,984.24	6.4
Michigan	80,150.00	80,150.00		1.8
Minnesota	2,488,707.73	2,468,224.86	20,482.87	509.5
Mississippi	288,524.53	164,210.19	124,314.34	12.8
Missouri	895,421.61	695,097.86		43.5
Montana	1,426,917.20	1,246,901.20	100,000.00	93.4
Nebraska	2,122,823.42	1,535,019.12	108,538.00	215.8
Nevada	1,349,395.18	1,349,395.18		173.0
New Hampshire	52,024.43	52,024.43		.3
New Jersey	66,077.87	66,077.87		6.1
New Mexico	1,873,447.55	1,873,447.55		210.5
New York	510,222.64	410,162.64	43,000.00	8.0
North Carolina	1,037,299.11	714,521.55	322,777.56	103.5
North Dakota	1,050,552.17	1,047,220.19	3,294.32	457.9
Ohio	1,035,375.47	1,030,181.63		27.8
Oklahoma	1,239,211.18	1,237,607.64		101.4
Oregon	1,525,235.01	1,392,618.01	84,317.50	98.9
Pennsylvania	254,788.81	254,421.79		4.4
Rhode Island	50,178.00	50,178.00		1.1
South Carolina	263,440.39	263,440.39		24.3
South Dakota	1,086,296.08	1,066,954.69	19,341.39	184.9

[1] No projects of this class completed in Indiana, Maine, and Maryland.

TABLE 18.—*Total cost and mileage of Public Works highway projects completed to June 30, 1934, and Federal funds allotted thereto, by States*—Continued

PROJECTS ON THE FEDERAL-AID SYSTEM OUTSIDE OF MUNICIPALITIES—Contd.

State	Total cost	Federal funds allotted		Mileage
		Public Works funds	Federal-aid funds	
Tennessee	$1,393,206.06	$1,180,143.76	$213,062.30	61.5
Texas	4,182,635.90	3,504,691.72		542.4
Utah	1,432,093.17	1,429,324.46		146.0
Vermont	90,524.22	89,926.93		7.4
Virginia	1,101,511.50	1,092,037.47	9,474.03	40.2
Washington	884,351.00	879,563.10	3,356.82	44.7
West Virginia	211,470.33	211,470.33		6.7
Wisconsin	1,073,457.39	1,063,118.67	1,190.00	50.0
Wyoming	1,005,126.46	882,673.00	80,400.00	177.9
Hawaii	122,232.70	109,225.57	12,994.32	6.3
Total	46,283,442.88	41,194,236.92	2,499,221.15	4,362.8

PROJECTS ON EXTENSIONS OF THE FEDERAL-AID SYSTEM INTO AND THROUGH MUNICIPALITIES [2]

Alabama	$183,974.41	$183,974.41		3.1
Arizona	179,423.43	177,982.55		4.0
Arkansas	267,409.01	239,810.94	$27,598.07	7.0
California	1,201,380.99	1,077,458.87		13.8
Colorado	890,911.16	845,103.51		17.2
Connecticut	48,325.68	48,325.68		.5
Delaware	82,851.95	75,106.31		.8
Florida	238,246.83	178,494.68	59,752.15	3.6
Georgia	270,623.84	270,623.84		12.4
Idaho	191,286.86	187,894.42		4.8
Illinois	213,649.45	213,618.50		3.7
Indiana	49,616.53	49,616.53		1.2
Iowa	703,618.21	667,865.00		23.6
Kansas	727,167.34	723,495.87		18.5
Kentucky	128,112.17	128,112.17		3.2
Louisiana	329,889.35	329,889.35		6.5
Maine	162,188.29	161,062.72		2.4
Massachusetts	96,850.68	73,850.68	23,000.00	1.8
Michigan	195,700.00	195,700.00		2.3
Minnesota	956,049.40	955,888.84		53.6
Mississippi	122,848.45	110,388.95	12,459.50	3.8
Missouri	559,179.26	533,233.11		12.7
Montana	345,305.18	345,305.18		9.2
Nebraska	269,117.63	268,428.34		11.7
Nevada	47,203.38	47,203.38		1.2
New Jersey	94,073.38	94,073.38		2.1
New Mexico	437,759.58	437,759.58		13.1
New York	259,723.17	259,341.87		4.0
North Carolina	588,701.49	586,560.20	166.10	30.4
North Dakota	128,994.64	128,994.64		9.3
Ohio	495,616.80	455,579.08		9.4
Oklahoma	220,928.88	220,571.20		7.9
Oregon	422,188.01	406,695.04	14,126.97	9.8
Pennsylvania	778,975.47	761,814.18		16.9
Rhode Island	54,063.40	54,063.40		1.2
South Carolina	147,768.44	147,768.44		4.1
South Dakota	183,149.74	183,149.74		8.1
Tennessee	307,829.45	307,829.45		6.7
Texas	1,605,904.15	1,523,073.09		56.4
Utah	619,858.49	603,798.90		13.9
Vermont	41,791.73	41,791.73		1.9
Virginia	402,536.67	381,276.18	8,760.49	10.9
Washington	1,187,895.49	1,173,567.02		20.7
West Virginia	87,291.15	87,291.15		1.9
Wisconsin	399,615.60	393,308.77		13.5
Wyoming	82,029.39	81,528.69		1.6
District of Columbia	289,445.89	289,445.89		2.4
Total	17,297,070.49	16,707,715.45	145,863,28	468.8

[2] No projects of this class completed in Maryland, New Hampshire, and Hawaii.

TABLE 18.—*Total cost and mileage of Public Works highway projects complete to June 30, 1934, and Federal funds allotted thereto, by States*—Continued

PROJECTS ON SECONDARY OR FEEDER ROADS [3]

State	Total cost	Federal funds allotted		Mileage
		Public Works funds	Federal-aid funds	
Alabama	$26,236.82	$26,236.82		0.1
Arizona	90,857.40	90,857.40		6.3
Arkansas	41,727.43	41,727.43		15.9
California	617,476.51	497,034.19		16.0
Colorado	617,189.08	616,485.80		82.2
Florida	397,589.88	397,589.88		26.0
Georgia	69,600.63	69,600.63		4.2
Idaho	650,200.91	588,778.89		70.8
Illinois	276,114.65	276,114.65		42.0
Iowa	238,660.03	229,800.00		49.2
Kansas	345,683.96	345,683.96		17.2
Kentucky	448,942.86	448,876.03		69.0
Louisiana	73,405.37	73,405.37		2.4
Maine	577,668.36	571,325.97		54.5
Maryland	22,217.70	22,217.70		1.9
Michigan	88,500.00	88,500.00		7.3
Minnesota	573,461.23	561,616.55		81.8
Missouri	504,000.61	504,000.61		141.8
Montana	712,695.05	712,695.05		97.6
Nebraska	213,260.07	213,260.07		70.3
Nevada	700,561.17	700,561.17		70.6
New Hampshire	82,647.15	82,647.15		2.5
New Mexico	351,481.58	351,481.58		62.1
New York	333,721.33	333,721.33		11.8
North Carolina	690,265.25	689,866.92		51.2
North Dakota	6,021.51	6,021.51		1.4
Ohio	610,460.00	610,460.00		159.9
Oklahoma	31,741.28	31,741.28		2.9
Oregon	541,068.81	502,843.61		41.7
Pennsylvania	258,906.83	258,906.83		30.0
South Carolina	54,313.20	54,313.20		1.6
South Dakota	183,741.74	183,741.74		73.2
Tennessee	342,701.04	342,701.04		29.3
Texas	2,385,381.53	1,835,753.10		408.9
Utah	523,984.51	504,437.24		107.3
Virginia	518,382.22	498,897.89		96.9
Washington	403,092.71	393,092.71		27.6
West Virginia	21,945.79	21,945.79		.7
Wisconsin	894,060.15	858,749.84		58.8
Wyoming	465,442.38	454,233.00		56.6
District of Columbia	208,113.99	208,113.99		2.6
Total	16,193,522.72	15,300,037.92		2,154.1

[3] No projects of this class completed in Connecticut, Delaware, Indiana, Massachusetts, Mississippi New Jersey, Rhode Island, Vermont, and Hawaii.

Of the 13,674 miles under construction at the end of the year, 6,949 miles were on the Federal-aid system outside of municipalities, 1,121 miles on extensions of the system into and through cities, and 5,605 miles on secondary or feeder roads. The estimated costs of each of these groups of projects, the sources of the funds employed, and the distribution by States are shown in table 19.

TABLE 19.—*Total cost and mileage of Public Works highway projects under construction on June 30, 1934, and Federal funds allotted thereto, by States*

PROJECTS ON THE FEDERAL-AID SYSTEM OUTSIDE OF MUNICIPALITIES[1]

State	Estimated total cost	Federal funds allotted		Mileage
		Public Works funds	Federal-aid funds	
Alabama	$4,625,778.67	$2,588,735.13	$2,037,043.54	272.3
Arizona	2,598,403.90	2,017,309.12		153.2
Arkansas	2,721,289.10	2,328,613.72	392,194.13	137.0
California	6,084,486.14	4,648,401.55		153.1
Colorado	2,059,925.09	1,926,296.72	27,435.65	54.9
Connecticut	1,543,762.06	1,367,983.12	175,778.94	30.7
Delaware	698,741.30	698,741.30		14.7
Florida	1,940,045.73	1,603,752.50	335,683.13	72.3
Georgia	2,400,287.81	2,400,287.81		177.5
Idaho	1,281,245.97	1,239,392.09		93.5
Illinois	2,712,498.06	2,712,498.06		45.1
Indiana	4,405,477.21	4,361,358.38		119.5
Iowa	4,126,332.98	3,828,980.00		185.6
Kansas	3,917,385.48	3,690,045.12		191.1
Kentucky	2,599,204.31	2,590,365.88		177.9
Louisiana	2,913,268.66	2,406,617.66		67.5
Maine	1,515,228.37	1,479,661.42		44.0
Maryland	801,143.78	791,495.03		14.9
Massachusetts	1,123,369.76	807,710.12	315,659.64	31.4
Michigan	5,177,180.00	5,128,180.00	49,000.00	243.8
Minnesota	1,980,571.21	1,949,360.33	27,500.00	237.7
Mississippi	4,586,982.35	2,481,349.56	2,067,000.85	235.2
Missouri	4,390,783.57	4,050,641.00	68,548.60	149.6
Montana	3,541,342.66	3,181,685.86	237,025.83	270.5
Nebraska	2,961,612.91	2,342,867.69		137.1
Nevada	1,401,020.43	1,401,020.43		87.1
New Hampshire	601,203.04	594,695.63		10.5
New Jersey	2,756,285.14	2,601,364.13	139,466.42	36.4
New Mexico	1,064,442.96	920,513.54	143,929.42	60.1
New York	11,280,608.68	9,660,723.68	315,000.00	230.0
North Carolina	3,310,836.86	2,957,506.09	353,330.77	465.1
North Dakota	1,513,926.68	1,315,248.81	198,677.87	404.6
Ohio	6,437,458.00	6,133,085.00	51,410.00	159.1
Oklahoma	2,931,335.69	2,931,335.69		196.3
Oregon	1,623,500.25	1,484,960.05	128,021.20	83.2
Pennsylvania	6,079,556.64	5,895,873.50		122.0
Rhode Island	937,119.34	937,119.34		19.4
South Carolina	2,039,404.99	2,036,675.37	2,729.62	186.3
South Dakota	1,849,893.45	1,542,099.63	307,793.82	250.2
Tennessee	2,914,317.84	2,553,157.65	361,160.19	104.0
Texas	7,415,941.62	6,877,286.38		457.5
Utah	798,151.16	798,151.16		48.8
Vermont	847,698.77	818,249.22		37.4
Virginia	2,115,368.45	1,992,162.00	119,858.30	81.4
Washington	2,095,806.01	2,095,806.01		60.9
West Virginia	1,706,233.68	1,700,233.68		64.9
Wisconsin	3,553,669.34	3,452,135.29	38,500.00	174.3
Wyoming	1,423,273.07	1,280,112.23	85,908.57	272.9
Hawaii	1,626,253.71	1,325,047.89	251,205.82	26.5
Total	141,029,652.88	125,926,891.57	8,229,862.31	6,949.0

[1] No projects of this class under construction in the District of Columbia.

TABLE 19.—*Total cost and mileage of Public Works highway projects under construction on June 30, 1934, and Federal funds allotted thereto, by States*—Con.

PROJECTS ON EXTENSIONS OF THE FEDERAL-AID SYSTEM INTO AND THROUGH MUNICIPALITIES [2]

State	Estimated total cost	Federal funds allotted		Mileage
		Public Works funds	Federal-aid funds	
Alabama	$1,133,335.74	$1,133,335.74		38.0
Arizona	300,059.89	300,059.89		7.3
Arkansas	1,112,223.25	1,058,589.04	$53,384.21	28.4
California	2,800,607.08	2,505,943.04		35.6
Colorado	651,210.04	651,210.04		13.4
Connecticut	687,857.65	684,715.77	3,141.88	9.2
Delaware	203,298.40	203,298.40		1.9
Florida	1,307,477.38	1,129,464.32	178,013.06	13.8
Georgia	1,047,709.04	1,047,709.04		35.3
Idaho	965,953.20	943,374.52		13.5
Illinois	6,298,412.04	6,298,412.04		64.2
Indiana	2,548,474.57	2,548,474.57		49.5
Iowa	1,319,843.17	1,247,030.00		21.6
Kansas	1,930,602.57	1,785,748.77		18.7
Kentucky	731,168.11	724,814.00		17.3
Louisiana	617,871.43	617,871.43		17.8
Maine	646,816.12	645,444.82		13.9
Maryland	390,738.31	386,588.31		3.6
Massachusetts	4,475,346.95	4,436,270.79	39,076.16	13.7
Michigan	2,722,745.00	2,720,595.00		35.2
Minnesota	1,880,914.07	1,869,617.18	2,500.00	41.9
Mississippi	638,526.86	638,526.86		25.4
Missouri	2,946,033.18	2,542,530.91		38.8
Montana	585,139.71	585,139.71		17.0
Nebraska	1,569,767.55	1,569,767.55		20.1
Nevada	411,763.76	411,763.76		7.0
New Hampshire	678,365.95	664,365.95		15.6
New Jersey	2,846,861.99	2,792,728.99	30,000.00	19.9
New Mexico	843,703.69	843,703.69		16.0
New York	8,006,217.60	7,489,785.00	39,000.00	57.7
North Carolina	962,606.47	961,328.18		34.4
North Dakota	454,556.75	427,371.39	27,185.36	13.7
Ohio	4,109,684.43	3,625,318.43		47.2
Oklahoma	1,664,345.07	1,664,345.07		32.0
Oregon	874,529.63	863,369.98		14.6
Pennsylvania	2,963,101.24	2,905,023.58		35.8
Rhode Island	338,974.92	338,974.92		5.2
South Carolina	725,672.31	725,267.30	405.01	30.2
South Dakota	680,060.88	680,060.88		21.9
Tennessee	1,140,039.95	1,140,039.95		14.3
Texas	3,146,496.84	3,079,890.27		49.4
Utah	54,015.64	53,422.98		2.8
Vermont	455,811.48	433,717.27	5,838.96	12.0
Virginia	1,330,699.04	1,142,139.89		12.1
Washington	786,454.90	786,454.90		11.7
West Virginia	950,313.53	925,967.79		16.2
Wisconsin	1,870,171.39	1,834,767.78	25,898.24	35.2
Wyoming	922,428.60	885,471.78		18.3
District of Columbia	680,633.97	663,650.15		2.3
Total	76,409,641.34	73,613,461.62	404,442.88	1,120.6

[2] No projects of this class in Hawaii.

TABLE 19.—*Total cost and mileage of Public Works highway projects under construction on June 30, 1934, and Federal funds allotted thereto, by States*—Con.

PROJECTS ON SECONDARY OR FEEDER ROADS

State	Estimated total cost	Federal funds allotted		Mileage
		Public Works funds	Federal-aid funds	
Alabama	$857,518.34	$857,518.34		59.7
Arizona	441,468.95	429,341.96		36.0
Arkansas	948,842.90	948,842.90		118.9
California	3,204,357.74	2,721,574.10		154.9
Colorado	1,025,898.66	994,429.71		94.0
Connecticut	664,915.58	659,120.00		14.5
Delaware	181,790.00	181,790.00		1.8
Florida	850,256.61	850,256.61		45.6
Georgia	920,605.43	920,605.43		77.3
Idaho	546,438.63	532,783.11		71.1
Illinois	4,610,167.64	4,610,167.64		268.3
Indiana	540,734.86	540,734.86		69.2
Iowa	1,821,511.10	1,640,950.00		214.0
Kansas	2,182,166.63	2,170,276.56		146.6
Kentucky	1,391,976.64	1,390,591.40		146.5
Louisiana	922,070.51	922,070.51		42.9
Maine	347,893.22	261,598.53		27.4
Maryland	577,528.60	563,602.60		44.0
Massachusetts	469,741.41	469,741.41		15.2
Michigan	2,798,900.00	2,798,900.00		218.3
Minnesota	1,619,796.48	1,613,476.33		190.1
Mississippi	801,275.41	801,275.41		92.4
Missouri	2,307,941.20	2,307,941.20		353.6
Montana	1,119,834.58	1,119,834.58		125.0
Nebraska	1,834,682.07	1,728,953.58		213.3
Nevada	307,468.71	307,468.71		28.2
New Hampshire	435,560.52	394,736.67		23.2
New Jersey	56,550.52	56,550.52		.5
New Mexico	874,633.59	874,633.59		240.3
New York	3,702,200.00	3,264,550.00		87.8
North Carolina	1,119,390.77	1,081,106.83		126.2
North Dakota	176,701.59	176,701.59		22.5
Ohio	3,316,490.00	3,016,818.00		142.5
Oklahoma	1,783,376.08	1,677,379.13		194.4
Oregon	1,050,254.52	928,020.15		55.7
Pennsylvania	6,821,281.19	6,735,617.79		605.3
Rhode Island	412,465.02	412,465.02		33.2
South Carolina	1,247,341.80	1,247,341.80		144.0
South Dakota	427,523.09	427,523.09		140.4
Tennessee	955,167.96	955,167.96		74.3
Texas	3,984,158.53	3,667,285.48		366.8
Utah	470,666.59	445,300.00		51.3
Vermont	444,002.49	424,132.63		36.0
Virginia	1,054,220.53	993,814.18		108.5
Washington	653,151.30	653,151.30		36.1
West Virginia	897,576.45	897,576.45		50.0
Wisconsin	1,333,491.78	1,288,586.71		95.3
Wyoming	626,347.56	611,181.00		91.6
District of Columbia	750,914.71	750,914.71		5.2
Hawaii	177,717.69	177,717.69		4.9
Total	66,066,966.18	63,502,117.77		5,604.8

Of the 1,718 miles in projects approved for construction on June 30, nearly 639 miles were located on the Federal-aid highway system outside of cities; 227 miles were made up of municipal extensions of the system; and 852 miles consisted of secondary or feeder roads. The distribution of these projects and other information concerning them are given in table 20.

TABLE 20.—*Total cost and mileage of Public Works highways approved for construction on June 30, 1934, and Federal funds allotted thereto, by States*

PROJECTS ON THE FEDERAL-AID SYSTEM OUTSIDE OF MUNICIPALITIES[1]

State	Estimated total cost	Federal funds allotted		Mileage
		Public Works funds	Federal-aid funds	
Alabama	$367,849.72	$233,948.59	$133,901.13	21.5
Arizona	96,740.98	96,740.98		10.7
Arkansas	673,389.29	636,509.29	36,880.00	24.0
California	1,041,371.05	191,793.40		15.9
Delaware	5,770.00	5,770.00		.3
Florida	56,281.75	56,281.75		.7
Georgia	517,218.84	517,218.84		22.4
Idaho	13,782.82	13,782.82		
Illinois	1,762,692.49	1,762,692.49		13.3
Indiana	692,050.37	657,562.62		13.2
Iowa	148,667.07	140,675.50		9.0
Kansas	25,391.30	25,391.30		.3
Kentucky	597,972.44	468,319.40		16.5
Louisiana	42,623.98	42,623.98		1.5
Maine	24,085.44	24,085.44		.2
Maryland	461,850.00	461,850.00		6.4
Michigan	602,366.00	602,366.00		21.0
Minnesota	153,425.81	143,425.81	10,000.00	12.7
Mississippi	501,945.70	276,070.22	225,875.48	29.1
Missouri	252,033.50	252,033.50		9.3
Montana	158,408.58	31,988.11	48,998.40	36.2
Nebraska	42,693.12	35,794.58		9.7
Nevada	122,456.09	79,129.02	43,327.07	
New Jersey	63,503.88	63,503.88		.6
New Mexico	41,901.88	41,901.88		3.6
New York	974,097.80	146,997.80	49,000.00	8.4
North Carolina	859,555.64	493,815.98	356,922.36	52.9
North Dakota	706,685.76	473,289.70	233,396.06	138.2
Ohio	196,500.00	77,878.00		5.0
Oklahoma	146,968.44	146,968.44		3.1
Oregon	235,870.38	167,388.02		1.4
Pennsylvania	630,347.36	477,382.67		5.7
Rhode Island	8,732.36	8,732.36		
South Carolina	144,097.11	144,097.11		9.0
South Dakota	232,337.41	143,477.48	88,859.93	41.9
Tennessee	390,724.63	390,724.63		24.2
Texas	410,924.29	328,563.97		26.2
Utah	68,204.10	68,204.10		.4
Vermont	3,998.46	3,998.46		
Virginia	414,970.61	387,355.78	27,614.83	23.8
Washington	64,640.67	64,640.67		1.4
West Virginia	34,029.42	34,029.42		.7
Wisconsin	66,816.72	63,174.25		1.4
Wyoming	83,169.89	67,031.52		10.2
Hawaii	426,495.88	248,693.76	129,332.90	6.8
Total	14,565,639.03	10,797,903.52	1,384,108.16	638.8

[1] No projects of this class in this status in Colorado, Connecticut, Massachusetts, New Hampshire, and the District of Columbia.

TABLE 20.—*Total cost and mileage of Public Works highways approved for construction on June 30, 1934, and Federal funds allotted thereto, by States*—Con.

PROJECTS ON EXTENSIONS OF THE FEDERAL-AID SYSTEM INTO AND THROUGH MUNICIPALITIES [2]

State	Estimated total cost	Federal funds allotted		Mileage
		Public Works funds	Federal-aid funds	
Alabama	$703,763.64	$703,763.64		18.4
Arizona	284,883.32	284,883.32		2.0
Arkansas	513,563.12	487,403.12	$26,160.00	5.8
California	797,671.66	586,972.69		3.6
Colorado	164,710.53	150,989.02		3.6
Connecticut	68,293.81	68,293.81		.5
Delaware	139,750.00	139,750.00		4.9
Georgia	250,709.42	250,709.42		11.9
Illinois	1,033,873.00	1,033,873.00		3.0
Indiana	1,419,950.27	1,419,950.27		19.3
Iowa	267,956.32	254,524.50		5.6
Kansas	13,156.36	13,156.36		.1
Kentucky	509,741.79	460,899.41		9.6
Louisiana	535,980.65	509,387.22	26,593.43	2.8
Maine	24,448.68	24,448.68		.4
Massachusetts	250,293.28	250,293.28		1.0
Michigan	414,075.00	414,075.00		3.5
Minnesota	306,952.70	291,480.62		4.8
Mississippi	302,596.74	302,596.74		7.1
Missouri	372,497.64	329,298.82		6.0
Montana	178,482.37	178,482.37		9.1
Nebraska	98,955.75	98,955.75		1.5
New Hampshire	50,553.20	42,274.05	8,279.15	.9
New Jersey	41,442.01	41,442.01		.5
New Mexico	84,837.68	66,812.89		3.2
New York	71,000.00	32,800.00		.6
North Carolina	306,693.48	285,608.05	1,885.81	10.0
North Dakota	596,045.77	595,459.44	586.33	25.2
Ohio	310,650.00	248,288.37		2.7
Oklahoma	196,978.40	196,978.40		4.5
Oregon	145,761.63	145,261.52		3.3
Pennsylvania	605,111.22	598,476.07		6.2
Rhode Island	157,015.50	106,638.68		1.0
South Carolina	251,062.11	251,062.11		7.8
South Dakota	280,530.04	280,530.04		9.0
Tennessee	415,580.88	415,580.88		4.8
Texas	761,103.20	609,566.77		9.0
Vermont	29,051.10	25,000.00		.7
Virginia	342,648.65	338,503.96		5.0
West Virginia	187,844.31	187,844.31		2.2
Wisconsin	259,388.07	259,388.07		3.1
Wyoming	45,961.52	45,380.40		3.2
Total	13,791,564.82	13,027,083.06	63,504.72	227.4

[2] No projects of this class in this status in Florida, Idaho, Maryland, Nevada, Utah, Washington, District of Columbia, and Hawaii.

TABLE 20.—*Total cost and mileage of Public Works highways approved for construction on June 30, 1934, and Federal funds allotted thereto, by States*—Con.

PROJECTS ON SECONDARY OR FEEDER ROADS [3]

State	Estimated total cost	Federal funds allotted		Mileage
		Public Works funds	Federal-aid funds	
Alabama	$960,759.52	$960,759.52		83.0
Arkansas	135,002.66	135,002.66		9.3
California	185,735.56	151,579.17		6.7
Colorado	139,684.71	80,000.00		3.4
Delaware	72,547.50	72,547.50		12.2
Florida	28,423.34	28,423.34		3.6
Georgia	277,397.03	277,397.03		25.2
Illinois	379,677.71	379,677.71		10.3
Iowa	663,054.66	341,495.00		58.9
Kansas	6,440.48	6,440.48		1.7
Kentucky	52,875.49	30,000.00		5.4
Louisiana	286,879.00	286,879.00		11.5
Maryland	262,345.90	262,345.90		17.0
Michigan	197,200.00	182,300.00		2.7
Minnesota	5,000.00	5,000.00		1.5
Mississippi	445,874.39	445,874.39		40.0
Missouri	50,017.33	49,901.33		5.1
Montana	26,572.33	26,572.33		3.5
Nebraska	12,325.86	12,325.86		.1
New Mexico	20,000.00	20,000.00		3.0
North Carolina	105,352.55	80,200.00		15.1
North Dakota	545,234.59	545,234.59		165.0
Ohio	193,150.00	193,150.00		2.5
Oklahoma	596,666.00	567,265.51		73.8
Oregon	120,230.36	95,860.24		11.1
Pennsylvania	252,768.17	252,768.17		20.7
South Carolina	63,136.00	63,136.00		8.7
South Dakota	410,634.58	410,634.58		153.1
Tennessee	636,341.23	636,341.23		48.8
Texas	203,289.06	117,416.66		2.5
Utah	68,967.69	68,967.69		5.9
Vermont	14,823.57	14,747.37		.4
Virginia	160,251.99	160,251.99		1.0
Washington	27,739.30	27,739.30		3.9
West Virginia	140,139.29	127,232.93		9.2
Wisconsin	148,404.19	148,404.19		16.6
Wyoming	59,918.00	59,918.00		9.6
Total	7,954,860.04	7,323,789.67		852.0

[3] No projects of this class in this status in Arizona, Connecticut, Idaho, Indiana, Maine, Massachusetts, Nevada, New Hampshire, New Jersey, New York, Rhode Island, District of Columbia, and Hawaii.

The classification of the mileage of Public Works highway projects by surface types is shown for each of the States and each class of project completed in table 21. Similar information concerning projects under construction at the end of the fiscal year is given in table 22, and for projects approved for construction at the close of the year in table 23.

TABLE 21.—*Mileage of Public Works highway projects completed, by types of construction, by States, June 30, 1934*

PROJECTS ON THE FEDERAL-AID SYSTEM OUTSIDE OF MUNICIPALITIES[1]

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total	Number of grade separation structures (mileage shown with bridges)	
		Untreated	Treated	Untreated	Treated	Untreated	Treated								Railroad—highway	Highway—highway
Alabama	6.0			4.9	4.7						46.0		0.3	61.9		
Arizona	29.0			22.8				76.6		1.0			1.7	131.1	2	
Arkansas				.4	3.8						5.2		.1	9.5	1	
California	.6			32.5	15.0		15.7	5.1		53.7	18.4		1.5	142.5	4	3
Colorado				90.9							4.3		.8	96.0	2	
Connecticut													.1	.1		
Delaware											3.0			3.0		
Florida	3.3						23.1				17.2		.1	43.7		
Georgia	9.9			4.9	14.2		12.7				31.8		.1	73.6	1	
Idaho				44.0				37.1		.4	.1		.2	81.8	1	
Illinois	.7										.1		.1	.9	2	
Iowa	22.3			25.8							26.1		.3	74.5	1	
Kansas	139.0	47.2		15.6							2.7	1.6	.4	206.5		
Kentucky				37.8				7.8			14.0			59.6		
Louisiana								.5			9.2			9.7		
Massachusetts									4.1		2.3			6.4	1	
Michigan											1.8			1.8		
Minnesota	41.4			357.2	15.6	13.2		60.0			21.9		.2	509.5	6	
Mississippi	6.1										6.6		.1	12.8		
Missouri				5.2							38.2		.1	43.5		
Montana				81.7				10.5					1.2	93.4	6	
Nebraska	29.7	100.8						43.4			41.6		.3	215.8		
Nevada				89.5				83.4					.1	173.0	1	
New Hampshire													.3	.3		
New Jersey											6.1			6.1		
New Mexico				18.9	84.3			94.8		11.3			1.2	210.5		
New York	.4									.1	7.5			8.0		
North Carolina	2.5	15.0	22.1		24.5	10.4	7.1	10.6		.9	10.1		.3	103.5	1	
North Dakota	146.1			311.4									.4	457.9	2	
Ohio				1.8						3.1	17.5	3.6	1.8	27.8		
Oklahoma	82.3			.8							12.7	4.9	.7	101.4		
Oregon	8.1			16.9			5.5		61.1	1.6	4.6		1.1	98.9		

[1] No projects of this class completed in Indiana, Maine, Maryland, and the District of Columbia

TABLE 21.—*Mileage of Public Works highway projects completed, by types of construction, by States, June 30, 1934*—Continued

PROJECTS ON THE FEDERAL-AID SYSTEM OUTSIDE OF MUNICIPALITIES—Continued

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total	Number of grade separation structures (mileage shown with bridges)	
		Untreated	Treated	Untreated	Treated	Untreated	Treated								Railroad—highway	Highway—highway
Pennsylvania	0.1										4.2		0.1	4.4		
Rhode Island									0.5		.6			1.1		
South Carolina			19.9								3.9		.5	24.3	1	
South Dakota	75.8			76.9				21.9			10.0		.3	184.9		
Tennessee	10.3							5.1			46.0		.1	61.5	1	
Texas	392.7			66.4	21.3			11.3		1.9	44.6	2.1	2.1	542.4	3	
Utah				8.6				108.9			28.0		.5	146.0		
Vermont								5.2	2.2					7.4		
Virginia	5.4	5.6	2.4	.3		6.0	9.3				10.7		.5	40.2	3	
Washington	6.6			27.9				.5			9.0		.7	44.7	2	
West Virginia				.3							6.3		.1	6.7		
Wisconsin								8.1			41.9			50.0		
Wyoming				119.4				58.3					.2	177.9		
Hawaii									6.3					6.3		
Total	1,018.3	168.6	44.4	1,462.8	183.4	29.6	73.4	649.1	74.2	74.0	554.2	12.2	18.6	4,362.8	41	3

PROJECTS ON EXTENSIONS OF THE FEDERAL-AID SYSTEM INTO AND THROUGH MUNICIPALITIES [2]

Alabama	0.5										2.5		0.1	3.1	1	
Arizona								2.1		1.4	.5			4.0		
Arkansas										2.1	4.9			7.0		
California					0.2			.7		6.3	6.2		.4	13.8	1	4
Colorado				1.4				.8	0.3	5.3	9.3		.1	17.2	1	
Connecticut										.5				.5		
Delaware										.2	.6			.8		
Florida							1.2				2.3		.1	3.6	1	
Georgia	.5			.4	1.1					.7	9.7			12.4		
Idaho				1.2				1.7		1.7	.2			4.8		
Illinois											3.1	0.6		3.7		
Indiana											1.2			1.2		

Iowa	3.1			1.4							19.0		.1	23.6	2	
Kansas	5.3	3.0		.2				.5		.9	7.3	1.3		18.5	1	
Kentucky											3.2			3.2		
Louisiana											6.4		.1	6.5		
Maine									.7		1.6		.1	2.4		
Massachusetts											1.8			1.8		
Michigan										2.2			.1	2.3		
Minnesota	7.0			28.3	3.3	0.8		1.6		3.5	9.0		.1	53.6	3	
Mississippi	2.4										1.4			3.8		
Missouri				.1	.4					1.4	10.7		.1	12.7		
Montana	.7			2.1				5.5		.4	.4		.1	9.2	4	
Nebraska	2.5	2.7									5.5	1.0		11.7		
Nevada											1.2			1.2		
New Jersey											1.4	.7		2.1		
New Mexico					7.8			2.8		1.3	1.0		.2	13.1	1	
New York	.4									1.8	1.8			4.0		
North Carolina	.4	1.1	1.9		3.8	.5	.4	2.7		10.0	9.6			30.4	1	
North Dakota	4.7			3.5						.6	.5			9.3		
Ohio				.3						3.2	2.9	2.9	.1	9.4		
Oklahoma	3.1									1.0	3.3	.5		7.9		
Oregon	.3			.6					.7	4.0	4.1		.1	9.8		
Pennsylvania							.2			10.4	6.2		.1	16.9		
Rhode Island									1.2					1.2		
South Carolina			1.1							.9	2.0		.1	4.1	2	
South Dakota	2.4							.5			5.2			8.1		
Tennessee	.2							1.2		.9	4.4			6.7		
Texas	14.0			6.9	9.1		.4			9.1	15.0	1.6	.3	56.4	2	
Utah											13.6		.3	13.9	1	
Vermont								1.2			.7			1.9		
Virginia		1.1	.9			1.1	.9			2.7	3.6	.6		10.9	1	
Washington	.1			1.4					1.4	2.5	14.8		.5	20.7		
West Virginia				.1						1.0	.8			1.9		
Wisconsin										.2	13.3			13.5		
Wyoming									1.1		.5			1.6		
District of Columbia										1.2	1.2			2.4		
Total	47.6	7.9	3.9	47.9	25.7	2.4	3.1	21.3	5.4	77.4	213.9	9.2	3.1	468.8	22	4

PROJECTS ON SECONDARY OR FEEDER ROADS[3]

Alabama													0.1	0.1		
Arizona	6.0												.3	6.3	1	
Arkansas				15.7							0.2			15.9		
California					7.6			7.9		0.2			.3	16.0		
Colorado				82.1									.1	82.2		
Florida							6.5	18.7			.8			26.0		
Georgia											4.2			4.2		
Idaho				67.9				2.8					.1	70.8		

[2] No projects of this class completed in Maryland, New Hampshire, and Hawaii.
[3] No projects of this class completed in Connecticut, Delaware, Indiana, Massachusetts, Mississippi, New Jersey, Rhode Island, Vermont, and Hawaii.

TABLE 21.—*Mileage of Public Works highway projects completed, by types of construction, by States, June 30, 1934*—Continued

PROJECTS ON SECONDARY OR FEEDER ROADS—Continued

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total	Number of grade separation structures (mileage shown with bridges)	
		Untreated	Treated	Untreated	Treated	Untreated	Treated								Railroad—highway	Highway—highway
Illinois				41.7									0.3	42.0	2	
Iowa	8.1			40.3							0.6		.2	49.2		
Kansas	14.6	0.9									1.7			17.2		
Kentucky	27.1			35.6							6.3			69.0		
Louisiana											2.4			2.4		
Maine				54.3								0.2		54.5		
Maryland							0.9	1.0						1.9		
Michigan				7.3										7.3		
Minnesota	47.1			34.6									.1	81.8		
Missouri	135.1			6.4									.3	141.8		
Montana				95.0				2.4					.2	97.6		
Nebraska	19.5	50.7											.1	70.3		
Nevada				55.7				14.9						70.6		
New Hampshire					1.0		1.4						.1	2.5		
New Mexico	7.5			54.5									.1	62.1		
New York								6.2		3.5	2.0		.1	11.8		
North Carolina		13.8		27.7	7.2			2.2					.3	51.2		
North Dakota	1.4													1.4		
Ohio	2.2		2.3	85.7	2.9	66.1					.2	.5		159.9		
Oklahoma										2.9				2.9		
Oregon	.8			9.9	19.6				10.9				.5	41.7	1	
Pennsylvania					2.9		7.9		18.8	.4				30.0		
South Carolina		.6	.9										.1	1.6		
South Dakota	22.0			51.2										73.2		
Tennessee	.4							4.6	13.0	2.4	8.9			29.3		
Texas	163.0			61.4	73.9	9.1		5.1	12.5	80.4	2.5		1.0	408.9	1	
Utah	2.3			97.0				7.0			1.0			107.3	1	
Virginia		23.9	26.5	38.5		4.0			3.8				.2	96.9	1	
Washington	8.6			18.9									.1	27.6		
West Virginia				.3							.3		.1	.7		
Wisconsin				46.7							12.0		.1	58.8		
Wyoming				51.2				5.3					.1	56.6		
District of Columbia										2.1	.5			2.6		
Total	465.7	89.9	29.7	1,079.6	115.1	79.2	16.7	78.1	59.0	91.9	43.6	.7	4.9	2,154.1	7	

TABLE 22.—*Mileage of Public Works highway projects under construction, by types of construction, by States, June 30, 1934*

PROJECTS ON THE FEDERAL-AID SYSTEM OUTSIDE OF MUNICIPALITIES [1]

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total	Number of grade separation structures (mileage shown with bridges)	
		Untreated	Treated	Untreated	Treated	Untreated	Treated								Railroad—highway	Highway—highway
Alabama	4.0		28.0	7.6	61.3			116.7		30.0	23.8		0.9	272.3	2	
Arizona	23.0			61.2				67.5			.6		.9	153.2	1	
Arkansas	9.0			77.8	5.3					11.6	31.5		1.8	137.0	2	
California	18.2			17.1	3.6			46.8	8.8	49.3	8.1		1.2	153.1	3	
Colorado	6.4			46.7							1.0		.8	54.9	4	
Connecticut				3.8					23.9		2.9		.1	30.7		
Delaware	5.3										9.3		.1	14.7		
Florida	16.5						12.4	31.0			11.8		.6	72.3	1	
Georgia	10.7	0.1	41.9	22.7	48.1		21.8	20.2		5.0	5.7		1.3	177.5	1	
Idaho	7.5			41.7				38.6		.1	5.3		.3	93.5		
Illinois	2.3										36.1	1.8	4.9	45.1	19	
Indiana	16.9									.2	100.4		2.0	119.5	3	
Iowa	80.7										102.4		2.5	185.6	8	
Kansas	126.2	9.5		5.4							46.1	2.2	1.7	191.1	1	
Kentucky	57.2			30.3				36.4	.8	11.6	40.8		.8	177.9		
Louisiana	10.3			2.2	7.5						45.9		1.6	67.5		
Maine					14.0				21.7	5.9	1.9		.5	44.0		
Maryland										9.6	5.2		.1	14.9		
Massachusetts									22.5	1.6	7.2		.1	31.4	1	
Michigan	33.8			88.5						3.5	117.4		.6	243.8		
Minnesota	66.0			70.2	10.4	50.4		40.3			.2		.2	237.7	3	
Mississippi	125.9		14.6	17.6	21.2						52.3		3.6	235.2	3	
Missouri	11.2			23.6						9.7	104.1		1.0	149.6	3	
Montana	30.6			161.0				68.8			9.3		.8	270.5	5	1
Nebraska	59.8	.6						20.3			54.4	.8	1.2	137.1	2	
Nevada				12.3				74.1		.6			.1	87.1	2	
New Hampshire					3.1		.7		2.5	.6	3.1		.5	10.5	1	
New Jersey	.2										36.1		.1	36.4	1	
New Mexico					32.6			11.9		15.3			.3	60.1		
New York	25.4			2.4				.1	5.5	43.4	152.3		.9	230.0	8	
North Carolina	6.4	56.9	178.7	28.7	67.0	30.8	64.2	18.2		12.7	1.0		.5	465.1		
North Dakota	262.5			82.6				59.5						404.6		

[1] No projects of this class under construction in the District of Columbia.

TABLE 22.—*Mileage of Public Works highway projects under construction, by types of construction, by States, June 30, 1934*—Continued

PROJECTS ON THE FEDERAL-AID SYSTEM OUTSIDE OF MUNICIPALITIES—Continued

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total	Number of grade separation structures (mileage shown with bridges)	
		Untreated	Treated	Untreated	Treated	Untreated	Treated								Railroad—highway	Highway—highway
Ohio	1.1			9.8			0.5	3.7	8.3	26.1	92.6	15.5	1.5	159.1		
Oklahoma	87.3			28.0	30.9					26.0	22.2		1.9	196.3	2	
Oregon	12.3			2.6	7.2	0.1	.4		47.7	7.6	5.0		.3	83.2		
Pennsylvania	9.4								20.5	17.3	73.8		1.0	122.0	1	1
Rhode Island									7.9	1.9	9.6			19.4		
South Carolina	22.6		150.4					5.3	3.1		4.6		.3	186.3	5	
South Dakota	123.7			.7				109.6			16.1		.1	250.2		
Tennessee	37.6								1.2	11.7	52.0		1.5	104.0	2	
Texas	243.2			51.3	60.9		8.0			41.8	47.7		4.6	457.5	7	
Utah				24.3				11.6		8.4	4.4		.1	48.8		
Vermont				6.0				23.3	.5		7.4		.2	37.4		
Virginia	4.5	1.1	18.1			11.2	36.6			4.2	4.4		1.3	81.4	5	
Washington	13.0			19.7							28.0		.2	60.9	3	
West Virginia	23.6						10.0			.1	30.8		.4	64.9	2	
Wisconsin	8.8			37.5				29.0		28.1	70.2		.7	174.3	5	1
Wyoming	17.3							255.5					.1	272.9		
Hawaii									26.3				.2	26.5		
Total	1,620.4	68.2	431.7	983.3	373.1	92.5	154.6	1,088.4	201.2	383.9	1,485.0	20.3	46.4	6,949.0	106	3

PROJECTS ON EXTENSIONS OF THE FEDERAL-AID SYSTEM INTO AND THROUGH MUNICIPALITIES[2]

Alabama			4.8		3.3		0.2	15.3		4.5	9.1	0.8		38.0	1	
Arizona								1.8	0.6	2.5	2.4			7.3		
Arkansas	0.2		.6	1.9	2.0			1.0		4.5	17.8		0.4	28.4	1	
California								.4	.3	26.4	8.3		.2	35.6		3
Colorado				.5			1.1	1.5	2.8	4.0	3.5			13.4		
Connecticut									.5	5.0	3.7			9.2		
Delaware										.8	1.0		.1	1.9		
Florida	1.3						.6				11.7		.2	13.8	2	
Georgia	2.0		3.9	3.2	7.8		13.0	1.1			3.5	.3	.5	35.3	3	

Idaho				3.4				4.8		3.2	1.9		.2	13.5	3	
Illinois										17.0	39.3	6.8	1.1	64.2	12	
Indiana	.3							1.5		23.6	23.6		.5	49.5	1	
Iowa	1.2										14.5	4.4	1.5	21.6	7	
Kansas	2.2	0.2								4.1	9.0	2.7	.5	18.7	2	
Kentucky	1.1			.3				4.5		6.8	4.4		.2	17.3		
Louisiana	11.5				1.3						5.0			17.8		
Maine					1.4				7.2	2.5	2.8			13.9		
Maryland										3.1	.5			3.6		
Massachusetts									4.1	3.5	3.2	.7	2.2	13.7	1	4
Michigan	1.2			.1						8.3	25.2		.4	35.2	3	
Minnesota	9.2			8.4		2.2		6.9		3.2	11.4		.6	41.9	4	
Mississippi	7.1		4.2	.7	3.3					2.4	6.4	1.2	.1	25.4	3	
Missouri	2.7			2.2				3.0		7.5	22.5		.9	38.8	5	
Montana				3.5				6.5		4.9	2.0		.1	17.0		
Nebraska	1.5	1.2						.7		2.4	12.2	1.9	.2	20.1	2	1
Nevada								1.9		5.1				7.0		
New Hampshire									2.4		13.2			15.6		
New Jersey	.3									1.4	18.1		.1	19.9	2	2
New Mexico					6.2			4.3		2.0	3.2		.3	16.0	1	
New York	6.2								.2	14.7	35.0	.8	.8	57.7	5	14
North Carolina	1.7	2.1	7.9		3.1	.2	3.0	1.7		8.7	5.8		.2	34.4	5	
North Dakota	2.5			2.8				2.3		2.0	4.0		.1	13.7	2	
Ohio	.9			.1					.9	12.9	16.7	15.2	.5	47.2	1	
Oklahoma	1.2									10.7	20.0		.1	32.0		
Oregon	.2			1.2	1.7		.5		1.9	2.0	7.0		.1	14.6	1	1
Pennsylvania									1.0	8.1	23.5	2.6	.6	35.8	1	
Rhode Island									2.4	1.7	1.1			5.2		
South Carolina	1.5		14.3					4.7		4.4	5.3			30.2		
South Dakota	2.2							6.7			12.4		.6	21.9	2	
Tennessee	.6									4.6	7.9	1.1	.1	14.3	1	
Texas	10.5			1.2	7.9		3.4			10.5	14.9		1.0	49.4	13	
Utah				.9						1.7	.1		.1	2.8		
Vermont				.1				.5	1.8	2.7	6.9			12.0		
Virginia		1.1	.3		.1	1.9	5.1		.2	2.5			.9	12.1	3	
Washington	1.4			2.2						1.9	6.1		.1	11.7	2	1
West Virginia				2.2			.7			4.2	8.7		.4	16.2	1	
Wisconsin	.9			5.8				2.1		5.0	20.1		1.3	35.2	2	
Wyoming								6.3	8.5		3.4		.1	18.3		
District of Columbia										1.5	.7		.1	2.3		
Total	71.6	4.6	36.0	40.7	38.1	4.3	27.6	79.5	34.8	248.5	479.0	38.5	17.4	1,120.6	92	26

[1] No projects of this class under construction in and Hawaii.

TABLE 22.—*Mileage of Public Works highway projects under construction, by types of construction, by States, June 30, 1934*—Continued

PROJECTS ON SECONDARY OR FEEDER ROADS

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total	Number of grade separation structures (mileage shown with bridges)	
		Untreated	Treated	Untreated	Treated	Untreated	Treated								Railroad—highway	Highway—highway
Alabama	4.8	7.9	12.8	12.4	20.9			0.4					0.5	59.7		
Arizona				.8				35.0					.2	36.0		
Arkansas				116.8	1.4								.7	118.9		
California	25.4			18.9	4.1			87.2		18.0			1.3	154.9		
Colorado	3.1			88.8	1.9								.2	94.0		
Connecticut									14.5					14.5		
Delaware										.9	0.9			1.8		
Florida	23.8		4.8				16.7						.3	45.6		
Georgia	6.5			42.2	19.3		4.1	4.6					.6	77.3	1	
Idaho	6.0			51.2				13.9						71.1		
Illinois	18.0			213.9				5.3			24.3	3.6	3.2	268.3	9	
Indiana				28.1	37.8						3.1		.2	69.2		
Iowa	173.6			25.0				5.1			9.5		.8	214.0	2	
Kansas	133.2			5.2							7.4		.8	146.6	1	
Kentucky	76.2			61.1						3.0	5.9		.3	146.5		
Louisiana	1.2			6.4	14.6						20.1		.6	42.9	1	
Maine				25.9	1.0								.5	27.4		
Maryland	1.4		2.0	9.6	1.7		10.0	3.1	14.1	1.3	.8			44.0		
Massachusetts								3.7	11.5					15.2		
Michigan	14.4			166.5				.4		19.0	17.7		.3	218.3		
Minnesota	154.0			26.7				4.0			5.1		.3	190.1		
Mississippi	55.8			30.8	5.0								.8	92.4		
Missouri	274.4			75.4				.9			1.2		1.7	353.6	3	
Montana	.3			107.3				16.1			1.1		.2	125.0		
Nebraska	136.4	64.9						3.9			7.2		.9	213.3		
Nevada	.4			27.8										28.2	1	
New Hampshire				.7			22.0		.5					23.2		
New Jersey											.5			.5		
New Mexico		33.0		207.3										240.3		
New York	.2			10.7						15.0	61.5		.4	87.8		
North Carolina		36.5	41.2	3.2	18.9	11.9	2.6	11.6					.3	126.2		
North Dakota	4.9			16.8						.8				22.5		
Ohio				81.5		3.9	.4	14.9		18.6	17.6	4.6	1.0	142.5	1	

Oklahoma	22.5			122.5	13.7					34.5			1.2	194.4	1	
Oregon				12.7	4.0		12.2		23.3	2.4			1.1	55.7		
Pennsylvania					72.3		202.0		308.7	8.1	13.9		.3	605.3	1	
Rhode Island					33.2									33.2		
South Carolina	9.7	3.2	127.4		3.6								.1	144.0		
South Dakota	73.3			67.0									.1	140.4		
Tennessee	34.8								29.1	9.9	.2		.3	74.3		
Texas	247.1			66.3	46.1		4.1				.6		2.6	366.8	5	
Utah	6.2			41.7						1.6	1.8			51.3		
Vermont				8.5				26.1	1.3				.1	36.0	1	
Virginia		22.3	19.0	6.8	11.1	6.8	10.6	31.5					.4	108.5		
Washington				29.9					3.4	1.0	1.7		.1	36.1	1	
West Virginia				8.4		1.0	38.8		1.7				.1	50.0		
Wisconsin				28.7				39.5			26.4		.7	95.3		
Wyoming				90.1				1.3					.2	91.6		
District of Columbia											5.2			5.2		
Hawaii									4.9					4.9		
Total	1,507.6	167.8	207.2	1,943.6	310.6	23.6	323.5	308.5	413.0	134.1	233.7	8.2	23.4	5,604.8	28	

TABLE 23.—*Mileage of Public Works highway projects approved for construction, by types of construction, by States, June 30, 1934*

PROJECTS ON THE FEDERAL-AID SYSTEM OUTSIDE OF MUNICIPALITIES [1]

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total	Number of grade separation structures (mileage shown with bridges)	
		Untreated	Treated	Untreated	Treated	Untreated	Treated								Railroad—highway	Highway—highway
Alabama	9.4		1.7	9.0				1.1					0.3	21.5		
Arizona								10.7						10.7		
Arkansas				6.9						14.0	2.2		.9	24.0		
California				3.0				3.5	5.4	3.8			.2	15.9		
Delaware											.3			.3		
Florida													.7	.7	1	
Georgia			4.0				11.1			3.8	3.4		.1	22.4	1	
Illinois	2.2										10.2		.9	13.3	9	1
Indiana										.9	12.0		.3	13.2	2	
Iowa								5.0			4.0			9.0		

[1] No projects of this class in this status in Colorado, Connecticut, Idaho, Massachusetts, Nevada, New Hampshire, Rhode Island, Vermont, and the District of Columbia.

TABLE 23.—*Mileage of Public Works highway projects approved for construction, by types of construction, by States, June 30, 1934*—Contd.

PROJECTS ON THE FEDERAL-AID SYSTEM OUTSIDE OF MUNICIPALITIES [1]

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total	Number of grade separation structures (mileage shown with bridges)	
		Untreated	Treated	Untreated	Treated	Untreated	Treated								Railroad—highway	Highway—highway
Kansas				0.3										0.3		
Kentucky	2.4			.2				5.2			8.4		0.3	16.5	2	
Louisiana			0.7	.8										1.5	1	
Maine													.2	.2		
Maryland	3.3										3.1			6.4		
Michigan	7.4			.2						6.0	7.2		.2	21.0	3	
Minnesota				5.7				7.0						12.7	1	
Mississippi	20.8		6.1								2.0		.2	29.1	1	
Missouri				1.7							7.5		.1	9.3	3	
Montana				11.1				25.0					.1	36.2		
Nebraska	2.4							7.3						9.7		
New Jersey											.6			.6	1	
New Mexico				3.6										3.6		
New York	1.6										6.8			8.4		1
North Carolina	4.7	9.4	.8	11.9	14.1			11.6			.2		.2	52.9	1	
North Dakota	66.7			41.2				30.2					.1	138.2	1	
Ohio				3.5						1.2		0.2	.1	5.0		
Oklahoma				.1				3.0						3.1	2	
Oregon											1.4			1.4	2	
Pennsylvania									4.0	.1	1.1		.5	5.7	2	
South Carolina			4.7								4.2		.1	9.0		
South Dakota	20.6							20.7			.5		.1	41.9		
Tennessee	17.2									5.8	1.2			24.2		
Texas	11.5				.5					13.6	.2		.4	26.2	1	
Utah				.3									.1	.4	1	
Virginia		.7	8.2			4.6	5.2	5.0					.1	23.8	4	
Washington				1.3									.1	1.4	1	
West Virginia				.2							.5			.7		
Wisconsin											1.3		.1	1.4		
Wyoming								10.2						10.2		
Hawaii									6.8					6.8		
Total	170.2	10.1	26.2	101.0	14.6	4.6	16.3	145.5	16.2	49.2	78.3	.2	6.4	638.8	40	2

Alabama	2.0		2.1		2.6		1.4	3.3		2.1	4.8		0.1	18.4	1	
Arizona								.5			1.2		.3	2.0	3	
Arkansas				0.1						1.2	4.2		.3	5.8	2	
California								1.4		2.0			.2	3.6		
Colorado								.5		1.7	1.4			3.6		
Connecticut										.5				.5		
Delaware										1.0	3.9			4.9		
Georgia			.5	2.0	.1		7.3			.8	1.2			11.9	1	
Illinois											2.9		.1	3.0	6	
Indiana										7.6	11.5		.2	19.3		
Iowa	2.3							.9			2.2		.2	5.6		
Kansas											.1			.1		
Kentucky	.6							1.0		.6	7.4			9.6		
Louisiana	.7										1.9		.2	2.8		
Maine									0.4					.4		
Massachusetts											1.0			1.0		
Michigan										2.4	1.0		.1	3.5		
Minnesota				.1				.9		1.5	1.0	1.3		4.8	3	
Mississippi	3.5				1.3					1.0	1.2		.1	7.1		
Missouri	.3			.3						2.8	2.4		.2	6.0	2	
Montana				2.7				5.6		.4	.4			9.1		
Nebraska	.2										1.3			1.5		
New Hampshire											.9			.9		
New Jersey											.5			.5		
New Mexico					.6			2.5					.1	3.2		
New York											.6			.6		
North Carolina		0.8	1.5		.5		3.0			2.3	1.9			10.0		
North Dakota	.1			1.3				19.4		.6	3.1	.7		25.2		
Ohio										.3	.7	1.7		2.7		
Oklahoma	.5				.4					2.0	1.5		.1	4.5	1	
Oregon									1.2		2.1			3.3		
Pennsylvania									.1	3.7	1.5	.7	.2	6.2	1	
Rhode Island										1.0				1.0		
South Carolina			1.7							1.7	4.4			7.8		
South Dakota								.7			8.3			9.0		
Tennessee										2.1	2.6		.1	4.8	1	
Texas	2.0				3.3		.1			2.6	.6		.4	9.0	4	
Vermont											.7			.7		
Virginia					.7		3.0			1.1			.2	5.0		
West Virginia				.1	.4					1.0	.4		.3	2.2	1	
Wisconsin										2.4	.7			3.1		
Wyoming								3.0			.2			3.2		
Total	12.2	.8	5.8	6.6	9.9		14.8	39.7	1.7	46.4	81.7	4.4	3.4	227.4	26	

[2] No projects of this class in this status in Florida, Idaho, Maryland, Nevada, Utah, Washington, the District of Columbia, and Hawaii.

TABLE 23.—*Mileage of Public Works highway projects approved for construction, by types of construction, by States, June 30, 1934*—Contd.

PROJECTS ON SECONDARY OR FEEDER ROADS[3]

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total	Number of grade separation structures (mileage shown with bridges)	
		Untreated	Treated	Untreated	Treated	Untreated	Treated								Railroad—highway	Highway—highway
Alabama	7.5	13.7	9.3	26.0	2.6	9.9	0.8	12.3			0.6		0.3	83.0	2	
Arkansas				9.1									.2	9.3		
California	1.2							5.5						6.7		
Colorado				3.4										3.4		
Delaware				12.2										12.2		
Florida			3.5										.1	3.6		
Georgia		7.6		12.4	5.0								.2	25.2	1	
Illinois								6.4			3.9			10.3	2	
Iowa	33.7							24.5			.2		.5	58.9		
Kansas								1.7						1.7		
Kentucky								5.4						5.4		
Louisiana	10.2			1.0									.3	11.5		
Maryland				7.8	1.0				4.0		4.2			17.0		
Michigan				1.6							1.0		.1	2.7		
Minnesota	1.5													1.5		
Mississippi	26.2	4.7		8.6									.5	40.0		
Missouri				4.3				.3		0.5				5.1		
Montana				3.5										3.5		
Nebraska	.1													.1		
New Mexico		3.0												3.0		
North Carolina		3.9	11.2											15.1		
North Dakota	133.0			31.9									.1	165.0		
Ohio										1.4		1.1		2.5		
Oklahoma				51.3				6.2		15.2	.7		.4	73.8		
Oregon				.5					10.4	.1			.1	11.1		
Pennsylvania					5.5		6.4		8.7				.1	20.7		
South Carolina	4.6	4.1												8.7		
South Dakota	33.2			119.9										153.1		
Tennessee	31.3			12.9					4.0				.6	48.8		
Texas	2.3												.2	2.5		
Utah				5.9										5.9		
Vermont									.4					.4		

Virginia		.4					.3					.3	1.0		
Washington				3.9									3.9		
West Virginia				3.1			6.1						9.2		
Wisconsin								13.5		3.1			16.6		
Wyoming	5.2			4.4									9.6		
Total	290.0	37.4	24.0	323.7	14.1	9.9	13.6	75.8	27.5	20.3	10.6	1.1	4.0	852.0	5

[3] No projects of this class in this status in Arizona, Connecticut, Idaho, Indiana, Maine, Massachusetts, Nevada, New Hampshire, New Jersey, New York, Rhode Island, District of Columbia, and Hawaii.

It will be noted that the completed projects included 70 structures separating the grades of railroad and highways at intersections and 7 highway-highway grade-separation structures. In course of construction at the close of the year were 226 other railroad-highway grade-separation structures and 29 structures eliminating level intersections of highways. To these will be added the 71 railroad-highway and 2 highway-highway structures shown in table 23 as approved for construction to make up the total of 405 grade-crossing-eliminating structures included in the Public Works highway program up to the end of the year.

The number of projects of this character included in the program is evidence of the importance attributed to the elimination of accident hazards in preparing the program of work under the National Industrial Recovery Act. In addition to the grade crossings eliminated by structures many more have been avoided by relocation of the highways as part of the improvement to be made; and the ends of safety are also served by the widening of existing surfaces, the easing of curves and grades, the lengthening of sight distances, and other marked betterments which result from the improvements planned and in course of realization.

Other major objectives to which, subject always to the primary employment purpose, special effort has been directed, include the closing of the remaining unimproved gaps in the Federal-aid highway system; and the provision of road facilities to aid in the better coordination of transportation, especially roads to local railroad stations and roads that will be capable of taking over the service heretofore rendered by nonpaying railroad branch lines.

Prominent also among the special objects sought by the Public Works expenditure is the landscaping of a reasonable mileage of roadsides. To provide for the inclusion of a reasonable amount of work of this character it was required that at least 0.5 percent of each State's apportionment of the Public Works funds should be devoted to it. A minimum of nearly $2,000,000 was thus assured for the pioneer work toward the ultimate elimination of unsightly roadside conditions, which, next to the provision of safe, convenient, and economical roadways, must be an object of all future road-improvement programs.

CONSTRUCTION OF ROADS THROUGH PUBLIC LANDS AND FEDERAL RESERVATIONS

Special appropriations for the survey, construction, reconstruction, and maintenance of main roads through unappropriated or unreserved public lands, nontaxable Indian lands, and other Federal reservations except national forests have been made by four Congressional acts passed up to the end of the fiscal year 1934.

As reported last year, the first two of these appropriations, aggregating $5,000,000, were made by the Emergency Employment Act of December 20, 1930, and the Emergency Relief and Construction Act of 1932. To this sum the National Industrial Recovery Act added $5,000,000, and the act approved June 19, 1934, $2,500,000.

TABLE 24.—*Status of appropriations for roads through public lands and Federal reservations, June 30, 1934*

State	Total sum apportioned	Sums allotted to projects—					Unobligated balance
		Not yet under construction	Under construction	Completed and finally inspected	Completed and final payment made	Total allotted	
Arizona	$1,456,479	$123,344.82	$522,508.71	$190,205.82	$620,376.38	$1,456,435.73	$43.27
California	891,893	205,000.00	546,847.35	22,713.90		774,561.25	117,331.75
Colorado	375,881	164,886.26	199,130.00			364,016.26	11,864.74
Idaho	543,486	12,125.39	265,590.00	101,200.93	164,569.68	543,486.00	
Montana	530,411		295,425.09	35,362.59	199,623.32	530,411.00	
Nevada	2,159,555	361,477.50	584,671.36	185,410.38	896,147.16	2,027,706.40	131,848.60
New Mexico	807,512		119,682.11	233,714.95	408,663.19	762,060.25	45,451.75
North Dakota	88,597	2,750.52	23,487.11	12,928.48	21,106.44	60,272.55	28,324.45
Oklahoma	104,733	62,200.02			41,460.41	103,660.43	1,072.57
Oregon	659,223	10,000.00	291,543.89	61,759.79	295,919.32	659,223.00	
South Dakota	198,725	132,794.43	65,715.00			198,509.43	215.57
Utah	1,100,495		534,823.61	22,136.95	543,534.44	1,100,495.00	
Washington	145,209		48,469.42	5,842.10	87,772.30	142,083.82	3,125.18
Wyoming	812,801	89,793.77		222,251.00	449,350.00	761,394.77	51,406.23
Total	9,875,000	1,164,372.71	3,497,893.65	1,093,526.89	3,728,522.64	9,484,315.89	390,684.11

Of the total of $12,500,000 authorized only the first $10,000,000 has been apportioned up to the close of the fiscal year. As deduction for administrative purposes was made from the first $5,000,000 only, the amount apportioned for road construction was $9,875,000. The States benefiting and the amounts of their apportionments are shown in table 24. The same table also shows the progress made toward expenditure of the funds in the several States.

RESTORATION OF FLOOD-DAMAGED ROADS

No addition has been made during the past year to the appropriations previously made for relief of States on account of damage to roads by floods.

Of the various appropriations those made to Vermont and New Hampshire and reported as expended in the last annual report are still the only ones completely expended. Of the appropriation to Kentucky nearly $300,000 was paid during the year and the unobligated balance was reduced by about $37,000.

There was no change in the status of the appropriations to Arkansas, Louisiana, Mississippi, Missouri, and Alabama; but with the exception of the last named these appropriations have no definite time of availability. Availability of the Alabama appropriation, extended to June 30, 1934, by the act of March 3, 1933, was further extended to June 30, 1935, by the Emergency Appropriation Act approved June 19, 1934.

Of the remaining appropriations—those to Georgia, South Carolina, and Florida—the first lapsed on June 30, 1934, with $18,771.85 still unobligated, that to South Carolina was completely obligated and in course of expenditure by June 30, and that to Florida was unaltered in status since the previous year's report.

The status of these several appropriations on June 30, 1934, is shown in table 25.

TABLE 25.—*Flood relief appropriated, amounts paid to States, and the unobligated balance of the appropriation on June 30, 1934*

State	Appropriated	Paid to States	Unobligated balance
Vermont	$2,654,000.00	$2,654,000.00	
New Hampshire	653,300.00	653,300.00	
Kentucky	1,889,994.00	1,234,442.47	$629,512.59
Total	5,197,294.00	4,541,742.47	629,512.59
Arkansas	1,800,000.00	1,477,693.56	322,306.44
Louisiana	967,582.00	786,271.13	181,310.87
Mississippi	628,000.00	345,266.57	282,733.43
Missouri	258,418.00	119,428.31	130,865.95
Total	3,654,000.00	2,728,659.57	917,216.69
Alabama	[1] 1,618,500.00	481,083.81	1,137,416.19
Georgia	[1] 505,167.50	464,351.67	[2] 18,771.85
South Carolina	[1] 801,361.00	782,362.18	
Florida	80,307.00	77,296.48	
Total	3,005,335.50	1,805,094.14	1,156,188.04
Grand total	11,856,629.50	9,075,496.18	2,702,917.32

[1] Does not include fund allowable for administration.
[2] Availability for obligation expired June 30, 1934.

The mileage of road improved under the flood-relief acts up to the end of the fiscal year and the corresponding total cost and Federal payment are given in table 26. Similar information for roads completed and paid for during the past year is presented in table 27; and for roads under construction and approved for construction in table 28.

TABLE 26.—*Total cost, flood relief, and mileage improved to June 30, 1934*

State	Total cost	Flood relief	Miles
Vermont	$5,651,965.83	$2,654,000.00	61.2
New Hampshire	1,408,479.45	653,300.00	29.1
Kentucky	2,951,767.56	1,213,483.95	209.2
Total	10,012,212.84	4,520,783.95	299.5
Arkansas	843,914.04	405,711.21	49.8
Mississippi	11,433.59	3,563.66	.3
Total	855,347.63	409,274.87	50.1
Alabama	319,797.49	155,615.15	41.7
Georgia	417,306.53	202,008.56	5.1
South Carolina	1,392,434.71	637,421.98	18.5
Total	2,129,538.73	995,045.69	65.3
Grand total	12,997,099.20	5,925,104.51	414.9

TABLE 27.—*Total cost, flood relief, and mileage of roads which were completed and paid for during the fiscal year 1934*

State	Total cost	Flood relief	Miles
Kentucky	$1,152,560.78	$463,142.88	106.1
Georgia	32,792.16	14,573.70	.3
South Carolina	161,643.66	77,700.00	.3
Total	194,435.82	92,273.70	.6
Grand total	1,346,996.60	555,416.58	106.7

TABLE 28.—*Total cost, flood relief, and mileage of roads under construction and approved for construction on June 30, 1934*

State	Total cost	Flood relief	Miles
Georgia	$70,249.18	$31,178.18	0.8
Kentucky	93,994.93	46,997.46	10.2
South Carolina	366,521.23	163,939.02	3.9
Total	530,765.34	242,114.66	14.9

The mileage of the several surface types represented in flood-relief roads completed and fully paid for during the fiscal year 1934 is given in table 29, and the total mileages completed, and under construction or approved for construction at the close of the fiscal year are given in tables 30 and 31, respectively.

TABLE 29.—*Mileage of various types of flood-relief roads completed and paid for during the fiscal year 1934*

State	Graded and drained	Gravel, untreated	Portland cement concrete	Bridges and approaches	Total
Georgia			0.2	0.1	0.3
Kentucky	100.9	4.6		.6	106.1
South Carolina				.3	.3
Total	100.9	4.6	.2	1.0	106.7

TABLE 30.—*Mileage of the various types of flood-relief roads improved to June 30, 1934*

State	Graded and drained	Sand-clay, untreated	Gravel, untreated	Gravel, surface treated	Macadam, surface treated	Bituminous macadam	Portland cement concrete	Bridges and approaches	Total
Vermont			7.0	9.2		6.1	32.5	6.4	61.2
New Hampshire				2.9	4.9	2.3	18.4	.6	29.1
Kentucky	203.0		4.7					1.5	209.2
Total	203.0		11.7	12.1	4.9	8.4	50.9	8.5	299.5
Arkansas	16.1		31.1				.3	2.3	49.8
Mississippi							.3		.3
Total	16.1		31.1				.6	2.3	50.1
Alabama	17.4	15.9	7.6					.8	41.7
Georgia		.4			3.3		.6	.8	5.1
South Carolina	10.1						5.3	3.1	18.5
Total	27.5	16.3	7.6		3.3		5.9	4.7	65.3
Grand total	246.6	16.3	50.4	12.1	8.2	8.4	57.4	15.5	414.9

TABLE 31.—*Mileage of the various types of flood-relief roads under construction and approved for construction on June 30, 1934*

State	Graded and drained	Sand-clay, untreated	Gravel, untreated	Macadam, treated	Portland cement concrete	Bridges and approaches	Total
Georgia				0.3	0.4	0.1	0.8
Kentucky	1.4		8.7			.1	10.2
South Carolina	2.9	0.4				.6	3.9
Total	4.3	.4	8.7	.3	.4	.8	14.9

WORK-RELIEF HIGHWAY PROJECTS

In the early fall of 1933 relief needs were especially urgent in a number of Western and Southwestern States in which farm crops had been destroyed or greatly reduced as a result of severe drought and, in the Dakotas, by a scourge of grasshoppers.

Relief authorities were desirous of providing useful work that could be done by those in need of aid, so that the relief extended would have as much as possible of the character of a wage paid for services rendered and as little as might be of the aspect of a dole. It was felt that road work of a simple but needed and useful character could be provided, but the effort to do so was embarrassed by the fact that the relief funds were usable only for relief purposes and could not be employed to pay for road materials and equipment and other nonservice items which enter in some part into even the simplest of road improvements. This difficulty was overcome by effecting an arrangement under which the Public Works Administration granted amounts necessary to pay such nonservice costs, limited to not more than 30 percent of the total expenditure, and the Federal Emergency Relief Administration supplied from its relief rolls and paid the necessary workers.

Under this arrangement the Bureau of Public Roads, cooperating with the respective State highway departments, assumed the responsibility of supervising the road work.

Work of this sort has been carried on during the fiscal year in 9 States on nearly 7,500 miles of road. The number of projects in each State, the estimated cost and amount payable from Public Works funds, and the mileage of road involved are given in table 32.

TABLE 32.—*Number and estimated cost and mileage of National Recovery work-relief projects undertaken during the fiscal year 1934, and Public Works funds involved*

State	Projects	Estimated total cost	Public Works funds	Mileage
	Number			
Colorado	3	$600,000.00	$180,000.00	155.0
Florida	1	1,000,000.00	300,000.00	(1)
Kansas	18	2,096,277.71	628,883.31	542.9
New Mexico	6	970,000.00	291,000.00	654.0
North Dakota	42	2,998,450.00	899,535.00	1,587.1
Oklahoma	7	1,740,000.00	522,000.00	460.6
South Dakota	54	3,300,000.00	990,000.00	1,341.0
Texas	34	6,548,620.10	1,964,586.02	975.0
Wisconsin	44	2,960,477.00	883,727.40	1,784.2
Total	209	22,213,824.81	6,659,731.73	7,499.8

[1] Repairs to roads and bridges damaged by floods.

LOAN-AND-GRANT HIGHWAY PROJECTS

Under the provisions of section 203 of the National Industrial Recovery Act, the Public Works Administration, during the course of the year agreed to finance or aid in the financing of, by loans or grants or both, the construction of roads in a number of States. The road-building activity thus provided for was additional to all other projects initiated under the grants specifically authorized for highway construction by sections 204 and 205 of the act.

Late in the fiscal year, the detailed administration of this work was transferred to the Bureau of Public Roads by the Public Works Administration. The status of the work transferred is given in table 33.

TABLE 33.—*Status on June 30, 1934 of loan-and-grant Public Works projects transferred by the Public Works Administration to the Bureau of Public Roads for supervision and audit*

State	Funds allotted by Public Works Administration			Mileage, estimated cost, and funds assigned to specific projects approved under Public Works Administration allotments				
	Tentative allotment by Special Board for Public Works	Allotment by contracts executed		Miles	Estimated total cost	Funds assigned		
		Grant	Loan			Grant	Loan	Other
California	$1,501,000	$1,501,000.00		10.7	$4,093,734.01	$1,161,560.98		$2,932,173.03
Connecticut	1,034,100	1,034,100.00		106.7	3,241,902.10	776,742.71		2,465,159.39
Illinois	88,500	84,000.00		2.9	225,241.66	67,572.51		157,669.15
Indiana	204,300	204,300.00		34.4	709,613.66	193,015.46		516,598.20
Iowa	406,400	380,100.00		142.8	75,610.74	22,683.21		52,927.53
Kansas	338,700	65,200.00		103.2	229,580.57	62,316.71		167,263.86
Maryland	5,411,866	1,411,866.00	$4,000,000.00	40.2	3,185,161.38	955,548.44	$2,229,612.94	
Massachusetts	1,574,500	1,574,500.00		86.5	4,675,767.61	1,381,857.94		3,293,909.67
Michigan	20,400	20,400.00						
Minnesota	627,500	209,000.00	385,000.00	210.8	653,382.93	180,553.65	287,294.29	185,534.99
Mississippi	531,000	131,000.00	400,000.00					
Missouri	1,805,000	1,805,000.00		.1	18,041.92	3,480.00		14,561.92
Montana	1,648,758	398,758.00	1,250,000.00	496.1	1,076,002.73	250,733.73	788,990.17	36,278.83
Nebraska	11,500	11,500.00		59.5	38,376.20	10,755.89		27,620.31
New York	3,204,733	1,033,799.90	2,170,933.10	3.2	143,950.00	34,000.00		109,950.00
Ohio	90,000	90,000.00		6.5	316,739.00	83,587.70		233,151.30
Texas	306,300	198,800.00		67.7	787,294.88	228,266.37	71,050.08	487,978.43
Vermont	9,000	9,000.00						
Washington	249,550	246,550.00		152.7	906,152.05	236,890.29		669,261.76
West Virginia	5,114,500	1,216,500.00	3,898,000.00	31.3	505,004.13	121,201.00	383,803.13	
Wisconsin	437,500			138.1	365,677.50	109,703.25	255,974.25	
Total	24,615,107	11,625,373.90	12,103,933.10	1,693.4	21,247,233.07	5,880,469.84	4,016,724.86	11,350,038.37

NATIONAL-FOREST-ROAD CONSTRUCTION

As explained in previous annual reports, the appropriations made for improvement of roads in the national forests have hitherto recognized and provided separately for the improvement of two principal classes of road designated, respectively, forest highways and forest-development roads. The latter, as the name implies, serve primarily for the development of the forests, the former are roads of a higher order of traffic importance, generally those joining sections of the Federal-aid or State highway systems outside of the forests or important community-service roads, requiring improvement generally more expensive than that required on forest-development roads.

In the main, the work supervised by the Bureau of Public Roads is limited to the construction of forest highways; forest-development road work is generally administered by the Forest Service. But, while this definition of the work of the two Bureaus is approximately correct, the exact line of separation is drawn between what are termed major and minor projects. Major projects, administered by the Bureau of Public Roads, include all projects in the forest-highway system, except those which do not require the technical services of a highway-engineering organization or those having an estimated average cost of less than $2,000 per mile. Those forest-development road projects of estimated average cost greater than $5,000 per mile and those requiring technical services are also classed as major projects.

Departing from the previous practice, Congress, in the National Industrial Recovery Act, did not attempt to delimit the amounts to be allotted to each of these classes of roads, but provided for both in a single authorization for the expenditure of not less than $50,000,000 for the construction of roads in several classes of Federally controlled areas including the national forests. Under this authorization the Public Works Administration allotted to forest highways $10,000,000 and to forest-development roads $5,000,000. Similar provision was made for continuance of the work in the Hayden-Cartwright Act which authorizes appropriation of $24,000,000 for the various classes of road work. Of this amount the allotment for forest highways is $7,000,000 and for forest-development roads $3,000,000.

In accordance with requirements of the governing rules and regulaticns a system of forest highways has been designated by concurrent action of the several State highway departments, the Forest Service, and this Bureau, and approved by the Secretary of Agriculture. Also, as required by the rules and regulations, the highways constituting this system have been classified as follows:

Class 1. Forest roads forming sections of the Federal-aid highway system, either wholly within or, when so designated by the Forester and the Chief of the Bureau of Public Roads, partly without and adjacent to the national forests.

Class 2. Forest roads, not of class 1, which are parts of approved State highway systems, when so designated by the Forester and the Chief of the Bureau of Public Roads.

Class 3. All other forest roads, of primary importance to counties or communities.

The roads which, according to these definitions, had been classified as forest highways, had an aggregate length on June 30, 1934, of 16,963 miles, classified as shown in table 34.

TABLE 34.—*Classification of the mileage of the forest-highway system as revised to June 30, 1934*

State	Mileage of forest-highway system			
	Class 1	Class 2	Class 3	Total
Western:				
Alaska			484.87	484.87
Arizona	320.6	245.0	495.90	1,061.50
California	578.4	1,357.0	406.9	2,342.3
Colorado	508.0	1,113.0	104.0	1,725.0
Idaho	687.21	176.6	184.5	1,048.31
Montana	628.3	335.8	240.0	1,204.1
Nevada	104.0	190.6	165.3	459.9
New Mexico	164.0	518.0		682.0
Oregon	524.66	418.68	422.13	1,365.47
South Dakota	227.0		86.0	313.0
Utah	96.65	530.30	110.2	737.15
Washington	386.5	135.4	247.9	769.8
Wyoming	387.3	37.0	217.7	642.0
Total	4,612.62	5,057.38	3,165.40	12,835.40

TABLE 34.—*Classification of the mileage of the forest-highway system as revised to June 30, 1934*—Continued

State	Mileage of forest-highway system			
	Class 1	Class 2	Class 3	Total
Eastern:				
Alabama	4.0		31.0	35.0
Arkansas	192.33	144.32	90.5	427.15
Florida	39.69	134.98	36.3	210.97
Georgia	41.8	37.5	68.7	148.0
Illinois			24.0	24.0
Kentucky	41.0	58.0	13.0	112.0
Louisiana	48.3	118.7	23.0	190.0
Maine			11.0	11.0
Michigan	49.91	108.5	150.3	308.71
Minnesota	89.50		222.2	311.70
Mississippi	32.0	13.0	78.0	123.0
Nebraska			28.8	28.8
New Hampshire	41.5	60.5	49.0	151.0
North Carolina	102.0	105.3	48.3	255.6
Oklahoma	31.48		70.5	101.98
Pennsylvania	134.0	248.0	25.0	407.0
Puerto Rico			21.0	21.0
South Carolina		26.0	11.0	37.0
Tennessee	83.8	105.0	79.0	267.8
Vermont	7.0		12.0	19.0
Virginia	79.0	117.9	210.0	406.9
West Virginia	76.0	102.0	62.0	240.0
Wisconsin	5.0	148.9	136.1	290.0
Total	1,098.31	1,528.60	1,500.70	4,127.61
Grand total	5,710.93	6,585.98	4,666.10	16,963.01

During the past year improvements were constructed on 938 miles of the forest-highway system, bringing the total mileage improved to date with Federal funds to 5,868 miles. Of the mileage improved during the year 877 miles were in the Western States and Alaska, and the remaining 61 miles were in the forests of 7 Eastern States. Of the total mileage improved to date 5,400 miles are in the West and 468 miles in the East.

The mileage of forest-highway projects constructed during the year and to date by States is shown in table 35.

TABLE 35.—*Mileage of completed forest-highway projects, by States*

State	Mileage of forest-highway projects completed		State	Mileage of forest-highway projects completed	
	During 1934	Total to June 30, 1934		During 1934	Total to June 30, 1934
Western:			Eastern:		
Alaska	6.4	235.7	Alabama		5.1
Arizona	106.8	496.0	Arkansas	17.4	102.2
California	202.3	712.7	Florida	16.4	56.6
Colorado	106.5	486.5	Georgia		21.4
Idaho	86.9	592.2	Michigan	5.9	36.4
Montana	52.0	533.0	Minnesota	13.9	107.4
Nevada	10.1	149.2	New Hampshire	5.1	13.2
New Mexico	62.9	282.6	North Carolina	1.3	46.4
Oregon	108.5	903.7	Pennsylvania	1.2	3.0
South Dakota	3.5	58.8	South Carolina		15.6
Utah	21.3	318.8	Tennessee		37.4
Washington	54.7	293.1	Virginia		19.3
Wyoming	55.0	337.9	West Virginia		3.6
Total	876.9	5,400.2	Total	61.2	467.6
			Grand total	938.1	5,867.8

On June 30, 1934, work was in progress under the supervision of the Bureau of Public Roads on 1,089 miles of road at a total estimated cost of $12,207568. Work estimated to cost $2,020,021 had been planned but not yet started; and there was a balance of authorized funds not yet obligated to definite projects amounting to $1,916,808.

ROAD CONSTRUCTION IN NATIONAL PARKS

During the fiscal year 1934 construction was completed on a total of 157 miles of roads in the national parks, making a total of 831 miles thus far improved. Under the agreement of several years' standing construction of these roads is supervised by the Bureau of Public Roads.

The mileage constructed during the fiscal year and to date in the several parks is shown in table 36.

TABLE 36.—*Mileage of national-park roads improved under the supervision of the Bureau of Public Roads*

National park or monument	Mileage completed under supervision of the Bureau		National park or monument	Mileage completed under supervision of the Bureau	
	During fiscal year 1934	Total to June 30, 1934		During fiscal year 1934	Total to June 30, 1934
Acadia	3.9	7.8	Mount Rainier	6.5	61.3
Bryce Canyon	1.8	16.2	Petrified Forest	9.6	26.3
Colonial National Monument	1.0	11.0	Rocky Mountain	2.1	38.9
Crater Lake	3.5	41.6	Scott's Bluff	.0	.6
Devils Tower National Monument	.0	.3	Sequoia	6.5	39.3
General Grant	.0	6.4	Shenandoah	.0	40.1
Glacier	7.1	54.4	Washington, D.C	.7	.7
Grand Canyon	21.4	151.1	Wind Cave	8.6	15.3
Great Smoky Mountains	4.0	4.0	Yellowstone	63.2	156.1
Hawaii	4.7	24.9	Yosemite	8.7	65.1
Lassen Volcanic	.0	30.4	Zion	3.4	18.9
Mesa Verde	.0	20.4	Total	156.7	831.1

During the past fiscal year Bureau activities on park-road construction were greatly expanded and the National Park Service was expanded to include national military parks, battlefields, and cemeteries. Over $20,000,000 has been appropriated for road construction under supervision of this Bureau in the national-park areas.

In the Western States the largest and most expensive project constructed by this Bureau was the Red Lodge-Cooke City National Park Approach road to Yellowstone National Park. This project lies in Montana and Wyoming and comprises a northeast entrance to Yellowstone Park. It is approximately 60 miles long, and on June 30, 1934, approximately 43 miles were complete. The remaining 17 miles will be completed during the season of 1934. Contracts have been let providing for surfacing and oiling of the road which will be done during 1935.

Another large project undertaken for the National Park Service is the Cameron-Desert View east approach to Grand Canyon National Park. The entire project is not complete, but approximately 18 miles were completed during the past year, and it is expected that the road will be graded and surfaced during 1935.

One new park of importance enters the list of those in which roads have been built by the Bureau, that of Great Smoky Mountains National Park in North Carolina and Tennessee. One project was completed during the past year. A very large project involving approximately $750,000 is under construction in this park.

Surveys and plans are progressing rapidly on the Shenandoah-Great Smoky Mountains Parkway connecting Shenandoah National Park in Virginia and Great Smoky Mountains National Park in North Carolina and Tennessee. An initial appropriation of $3,960,000 has been made for this project. When completed this road will extend along the ridge of the Blue Ridge Mountains and will be one of the most scenic mountain drives in the eastern part of the country.

The Green Mountain Parkway in Vermont is another large project which is now being surveyed. No funds have been appropriated for the construction to date, but a $40,000 allotment has been made for survey and plans.

Nearly $12,000,000 of road work is under construction with funds made available by the National Industrial Recovery Act. Of this amount approximately $8,000,000 is under construction in the West and $4,000,000 in the East. These figures represent 78 projects of which 61 are located in the West and 17 in the East.

INTER-AMERICAN HIGHWAY

A report of a reconnaissance survey for the proposed Inter-American Highway from Panama to the United States was prepared during the first half of the fiscal year and transmitted to the Department of State on January 22, 1934. The President of the United States in turn transmitted this document to the Congress on March 6. Printing of the report as a congressional document was authorized by Senate Resolution 271, under date of June 6.

The report covers reconnaissance surveys over the proposed line of the highway through the Republics of Panama, Costa Rica, Nicaragua, Honduras, and Guatemala, supplemented by aerial photographs.

In addition to necessary engineering details and cost estimates, with plan and profile maps, the report contains detailed analysis of the economic characteristics of each of the countries involved. The five republics listed above made official request for the reconnaissance survey, but the report treats also of the countries of El Salvador and Mexico which are traversed by the highway. The entire route from Panama City to Nuevo Laredo, Mexico (on the boundary between Mexico and the United States) is approximately 3,200 miles long.

The continued interest of the Congress in this project was evinced by its authorization in June 1934 of $1,075,000, in two separate bills, for further survey and initial construction activities.

TRANSPORTATION AND ECONOMIC AND STATISTICAL INVESTIGATIONS

WASHINGTON REGIONAL AREA TRAFFIC SURVEY

Compilation of a report on a traffic survey of the regional area of Washington, D.C., was nearing completion.

Detailed recommendations with regard to proposed new routes and bridges are a part of the report, and data with regard to present volume of traffic, the type and composition of this traffic, and studies of its normal movement are also presented. This material will be found useful in the study of numerous problems which are not touched upon in the report itself. Large savings in right-of-way and construction costs should be realized from the detailed data and recommendations resulting from the survey.

INDIANA TRAFFIC SURVEY

The fieldwork of the Indiana traffic survey was completed in the fall of 1933, and since that time the Bureau has had no personnel on the work. The analysis has been handled in accordance with the agreement by the State highway commission. The survey was largely for administrative purposes of the State Highway Commission of Indiana and a report will be issued by the commission.

NEW JERSEY TRAFFIC SURVEY

Field operations for a survey of traffic upon the entire State highway system of New Jersey and upon a limited mileage of the principal county routes were completed in September 1933, and the resulting report is now in process of preparation.

The report will contain data with regard to the origin and destination of truck traffic, the nominal capacities and body types of trucks, their classification as owner-operated, contract haulers, or common carriers, and as of interstate or intrastate operation, the origin and destination of all vehicles observed at the Hudson and Delaware River crossings, and the determination of passenger-car traffic upon each of the highway systems which is local to each county or which originates in other areas.

FLORIDA TRAFFIC SURVEY

A 12-month survey of traffic on the highways of Florida was begun in September 1933.

This project is to obtain complete data with regard to present use of the State highway system. At certain major points in the citrus area, the volume and movement of citrus-hauling trucks will be studied. Complete analysis of the volume and movement of tourist traffic, together with detailed data with regard to their expenditures, speed of travel, purpose in visiting Florida, length of stay, and areas of origin, are a part of the survey.

CONNECTICUT TRAFFIC SURVEY

Field work on a 12-month survey of traffic in Connecticut was begun in October 1933.

Truck data relating to origin and destination, classification of trip as city or country; situs of ownership of vehicles, as city, village, or farm; and classification of operators as private, contract haulers, or common carriers, are a part of the project. The volume of trucks engaged in railway service will be obtained and trucks will be weighed at all points where scales are available.

ARKANSAS TRAFFIC SURVEY

Field work was begun at approximately 250 points in Arkansas in April 1934.

Data for passenger-car and bus traffic will cover the following items: State of registration, route used, classification of trip as State or interstate, situs of ownership, and travel, with either origin or destination at railroad stations. The same information will be obtained for trucks, and, in addition, information with regard to the following: Make of vehicle; wheel loads (obtained by weighing on portable scales); rated capacity; number of trailers; classification, as owners, contract haulers, or common carriers; commodities carried; and whether or not return loads are picked up.

TRAFFIC CAPACITY AND INTERSECTION STUDIES

The studies of intersection efficiency were continued, to include analysis of the movement of vehicles at some 20 intersections, most of which were operated under at least two different control methods. The results of the Seventeenth Street and Constitution Avenue analysis (Washington, D.C.), and of the study of the time saving over the New Jersey high-level viaduct, were presented before the Highway Research Board, and were reported also in Public Roads.

New and improved methods of recording developed during the year have made possible studies of the movement of individual vehicles. These methods will permit analysis of highway capacity under various conditions of traffic and alignment, of vehicle speeds on the open highway, and of the efficiency of intersections carrying the heaviest traffic volumes.

ORGANIZATION OF AMERICAN ASSOCIATION OF MOTOR-VEHICLE ADMINISTRATORS

Continuing its interest in the problem of greater uniformity in State laws and regulations affecting the registration of motor vehicles and their operation on the highways, the Bureau participated in the formation of the American Association of Motor Vehicle Administrators at a meeting held in Chicago in September 1933. This new organization comprises in its membership the various State administrative officials having jurisdiction over all phases of motor-vehicle operation. It embraces four regional groups (East, South, Midwest, and West), all of which had been officially organized with closely similar constitutions and bylaws by the end of June 1934. The Bureau holds an active membership in the national association, and acts in an advisory capacity with the regional groups. This new organization is regarded as an effective channel for contacts with the growing movement toward promotion of safety on streets and highways and greater uniformity in State motor-vehicle laws.

NATIONAL CONFERENCE ON STREET AND HIGHWAY SAFETY

The Bureau assisted in the holding of the Fourth National Conference on Street and Highway Safety, at Washington, D.C., in May 1934. This conference adopted a revision of the Uniform Motor Vehicle Code, bringing this document up to date.

The code now contains the following acts, designed for the consideration of and enactment by State legislatures: (1) Uniform motor vehicle administration, registration, and certificate of title and antitheft act; (2) uniform motor vehicle operators' and chauffeurs' license act; (3) uniform motor vehicle civil liability act; (4) uniform motor vehicle safety responsibility act; (5) uniform act regulating traffic on highways. Two other documents completed the work of the conference—a model municipal traffic ordinance and a manual on uniform traffic-control devices. The conference attracted a large attendance of public officials and other traffic specialists from all parts of the country, whose collective experience and judgment were embodied in the uniform acts as adopted.

STUDIES OF TAXATION

A series of studies of the finances of various States, with special reference to highways, was continued during the past fiscal year.

An inquiry into the tax situation in New Hampshire was conducted. Similar studies were begun in Minnesota, Colorado, Wyoming, and New Mexico. The results of investigations of this character in Wisconsin, Illinois, and Michigan have already been published. The general purpose of all these studies is to establish the relation of highway taxes paid from different sources and by different groups of citizens to highway expenditures, and to lay down a broad basis for adjustment of highway taxes on a rational plan.

MOTOR-VEHICLE TAXATION IN 1932

A special statistical survey of motor-vehicle taxation in the United States in the year 1932 was made during the past fiscal year, and the resulting report is now being prepared for publication. This inquiry elicited, for the first time, facts in complete detail regarding the many types of fees and taxes paid by owners of all classes of vehicles in all the States. Another phase of the survey related to local fees and taxes, including county and municipal imposts, and personal-property taxes. This investigation revealed both the extent and diversity of motor-vehicle taxes, and showed total collections in the year 1932 of slightly more than 1 billion dollars.

WIDTH OF HIGHWAY USED BY VEHICLES IN PASSING

Observations were made of highway traffic in the vicinity of Baltimore, Md. to obtain information concerning the position upon the highways of various types of vehicles in the act of passing one another in either direction, as well as the longitudinal distance required for completing the passing maneuver when the vehicles are moving in the same direction. A motion-picture camera mounted in an observer's car moving in the stream of traffic was used. It is planned to publish the results of these tests.

RAILROAD LINE ABANDONMENT STUDIES

By arrangement with the Interstate Commerce Commission and the American Railway Association, the bureau undertook to make studies of branch lines and sections of railroad proposed for abandonment, with a view to ascertaining the effect of such action on highway traffic in the immediate vicinity. Cases studied included both those under formal application to the Interstate Commerce Commission and those informally proposed by the railroads through the American Railway Association. A detailed inspection was made of the territory served by the existing railroad, with special reference to the amount of traffic which would result if freight transported by rail should be carried on the roads, and to the condition of the existing roads leading from each population center or railroad station to the nearest available station after abandonment. The potential highway traffic was estimated as an annual daily average in truck loads based on a 5-year period, and for maximum average truck loads per day for the peak month.

Distances, types of road, condition of bridges, and other relevant features were reported, in order that a definite determination might be made as to the amount and kind of highway construction or reconstruction which would be necessary to provide equivalent service to that furnished by the rail line proposed for abandonment.

During the fiscal year 72 cases were studied, involving 1,893 miles proposed for abandonment, distributed among the States as shown in table 37.

TABLE 37.—*Sections of railroads proposed for abandonment and inspected during fiscal year*

State	Projects	Railroad	High-ways in-spected	State	Projects	Railroad	High-ways in-spected
	Number	*Miles*	*Miles*		*Number*	*Miles*	*Miles*
Alabama	1	21.00	60	Missouri	7	204.50	373
Arkansas	3	112.10	242	New Hampshire	4	102.70	171
Delaware	1	34.60	78	New Jersey	2	15.46	31
Florida	1	27.42	48	New York	2	28.88	48
Illinois	2	39.83	85	North Carolina	2	17.74	52
Iowa	3	72.85	134	Oklahoma	1	10.61	13
Kansas	7	445.23	673	Pennsylvania	4	74.63	132
Kentucky	3	63.52	185	Tennessee	3	39.66	149
Louisiana	1	43.05	35	Texas	3	127.23	256
Maryland	1	5.00	12	Virginia	4	69.44	176
Massachusetts	3	24.53	78	West Virginia	1	8.00	24
Michigan	2	45.64	124	Wisconsin	6	151.18	285
Minnesota	4	70.36	159				
Mississippi	1	37.90	89	Total	72	1,893.06	3,712

This work was done for the purpose of determining the selection of secondary or other roads which should be built to serve communities in the regions of the abandonments.

PRODUCTION-COST STUDIES

PRODUCTION COSTS ON RELIEF PROJECTS

During the past year requirements in the administration of highway work, especially those pertaining to employment of labor, and assistance in connection with such activities as drought relief, flood relief, and civil works, necessitated a considerable curtailment of the usual production studies.

However, the drought and flood-relief road work carried on in nine States since the fall of 1933 has produced much valuable information and experience aside from providing needed road improvements and giving employment to needy farmers. At the period of maximum activity during the fiscal year about 20,000 local destitute workers in 8 States were given employment and their efforts utilized so effectively that on the whole every dollar of public expenditure is believed to have yielded a dollar's worth of useful and needed improvement. This belief is based on many concrete and exact data from each of these States. Reports from Kansas may serve as an example.

In the 18 drought-stricken counties of southwestern Kansas the Kansas State Highway Commission in cooperation with Federal authorities provided employment for able-bodied, needy farmers in the improvement of some of the most important of their local roads. During November and December 1933 and January 1934, the State highway commission started 59 of these road projects, using men taken from the relief and civil-works lists. These 59 road projects involved a total of 349 miles, but during the 3 months the major part of the actual work was confined to approximately 126 miles, on which a total of 1,270,000 cubic yards of excavation were moved, mostly with fresnoes, culverts were constructed, the roadway and slopes finished, right-of-way cleared, and fences built—all at a total cost of $337,500. Applying the total cost to the grading only results in a cost of 26.6 cents per cubic yard. Of this total expenditure, 88.4 percent was paid directly to the laborers for personal services and the use of their personally owned teams and trucks. The remaining 11.6 percent was spent largely in the purchase of materials and in providing supervisory labor and the necessary tools and equipment. These expenditures include all miscellaneous and incidental labor connected with the completion of the road, such as finishing the slopes and shoulders, placing culverts (but not the cost of culvert materials), moving and erecting fences, together with some long-haul fills and clay and caliche surfacing in which wagons and trucks were used and the materials loaded by hand. Table 38 shows the relative average amount of human and team labor required per cubic yard on this work.

TABLE 38.—*Man-hours and horse-hours per cubic yard of excavation on relief projects in Kansas*

Class of work	All grading work except wagon and truck haul [1]	Jobs using only fresnoes	Wagon- and truck-haul work with hand loading
By men:	*Hours*	*Hours*	*Hours*
Dirt-moving organization	0.299	0.338	1.259
Hand finishing slopes	.106	.103	
All other labor	.045	.044	.028
Total man-hours per cubic yard of excavation	.450	.485	1.287
By horses:			
On fresnoes	.520	.505	.104
On plows	.098	.098	.110
On wagons	.008	.038	.474
On all other work	.040	.026	.036
Total horse-hours per cubic yard of excavation	.666	.667	.724

[1] Includes 8 jobs on which the elevating grader was used to throw up approximately 84,200 cubic yards on the grade. Total yardage handled exclusively by fresnoes was 1,140,700; by elevating grader, 84,200; and by trucks and wagons, 47,500. Wage rates were almost uniformly 40 cents an hour for labor and 7½ cents an hour for horses.

While the primary object of this work was to provide relief and consequently the crews were not always well balanced in respect to the number of teams available and the individual members changed a great deal, it is clear from table 38 that the production rates per man-hour and per horse-hour are very creditable for this type of work. These people not only supported themselves, their families, and their livestock throughout the winter by their own efforts, but in doing so they made a definite contribution to the future welfare and improvement of their communities in the form of needed public highways, which in mileage and in quality represent a value fully equal to the total outlay.

Continuing former studies of the extent to which labor profits from the construction of high-type pavements in which mechanical equipment plays an important part, a number of corollary studies have been carried on to determine more fully the returns to labor from other types of construction. Considerable time has been devoted to obtaining adequate records of the amount of employment actually provided by the current State and Federal-aid highway-construction program in each of the several States. As a part of this plan a weekly record is obtained of the number of persons actually employed on State and Federal road work. This provides a definite means of predicting the total amount of employment which would be provided by any given expenditure.

It was found impossible to continue active field work on a number of studies during the past year, and the data which had been obtained were analyzed and prepared for publication. Reports were prepared on the construction of high-type bituminous pavements, some new relations bearing on concrete mixtures, and power-shovel operation in highway grading.

The first report is based on the analysis of detailed studies on 23 bituminous paving jobs. The causes of reduced production rates and high unit costs are given and methods whereby these causes may be eliminated or reduced are discussed.

STUDIES OF CONCRETE MIXTURES

Studies of concrete mixtures have developed indications of certain relations not heretofore established between the proportions of the solid ingredients of the concrete, the water content, and the strength and density of the resulting concrete. These relations may be stated briefly as follows:

For a particular combination of sand and cement a relation exists between the amount of coarse aggregate and (1) the total voids in the concrete mixture and (2) the amount of water required for basic or any relative proportion of basic water contents.[1]

[1] Basic water content is that amount of water which produces maximum density in a particular combination of materials. Quantities of water expressed in terms of basic water content (as a ratio) are referred to as relative water contents.

Likewise, for a particular coarse aggregate content, a relation exists between the ratio of the amounts of sand and cement in the mixture and (1) the amounts of water required as the basic and various relative water contents, and (2) the corresponding total voids in the mixture. As the sand-cement ratio is uniformly increased, a uniform change occurs in the amount of water required for the basic and each relative water content and the total voids in the concrete corresponding to each. In these tests, increase in the ratio of sand to cement resulted in an increase in both the amounts of water required for each relative water content and the corresponding total voids in the concrete.

For each relative water content, using the same kinds of materials, the slump of every concrete mixture will be the same, regardless of the proportions of cement and aggregate used in it.

GRADING STUDIES

In the studies of power-shovel operation in highway grading it was found that the management was the most important single factor affecting production costs; that the hauling usually presented more difficult problems than the digging and loading; and that in rock or hard ground the drilling and blasting are frequently the most poorly managed operations on the job. These studies cover several hundred projects distributed over practically all parts of the country and should therefore form a fairly accurate indication of present practice, as well as a basis for evaluating the efficiency of different methods of operation and procedure.

The studies begun last year of the man-hours and equipment-hours involved in the numerous unit items of the various types of highway construction were discontinued soon after the opening of the fiscal year. The need for more precise knowledge of the amount of human labor required in each road-building and maintenance operation, and the extent to which the labor element varies with different methods and different kinds of equipment is so urgent, however, that these studies should be resumed at the earliest opportunity. In adopting means for relieving unemployment, both the legislator and the administrator are in need of comprehensive data.

HIGHWAY ACCOUNTING METHODS

The Bureau has continued its efforts to further the development and installation of efficient accounting procedures by highway-building agencies. It has a direct interest as a result of its cooperation with the States in road construction and also because of its collection of general statistics in the highway field. Accurate and complete information in regard to the various activities in which a highway department is engaged is a prerequisite to efficient administration. Efficient and effective statistical and accounting control is necessary not only for administrative reasons but also to provide the engineering organization with proper means for determining costs and properly evaluating and comparing the relative merits and demerits of both new and old procedures, methods of operation, and types of organization. For these accumulations of experience and data to be of the widest possible value it is necessary that the statistical methods, terms, and nomenclature be uniform among the several States so that the accomplishments of one can be fairly compared with those of any other. As yet, such comparisons can be made only between a few States. The aim of the Bureau is to provide a system of accounts and records that will be economical in operation, will fully meet all accounting requirements of a department, and will provide quickly and in practical form complete statistical information on any desired activity in which a department is engaged, and which shall be fully comparable with similar activities in any other State. Cooperative work along these lines was continued during the year insofar as time and opportunities would permit.

PHYSICAL RESEARCH

MOTOR-VEHICLE IMPACT INVESTIGATIONS

The current research in this field is the study of the effect on pavement surfaces of the suddenly applied forces developed by motor-vehicle impact as compared with the effect of static or slowly applied forces of the same magnitude. Preparations have been made for laboratory tests under carefully controlled conditions of temperature and moisture. These tests will be made upon massive specimens of concrete mounted as cantilevers utilizing a specially designed pendulum-type impact machine to produce the impact. This machine, now practically completed, consists of a structural frame carrying a vertical pendulum

100 inches in length with a motor-truck wheel mounted at its center of percussion. The pendulum is to be swung against the vertical face of the test specimens and the strains and deflections of the specimens under the resulting impact reaction will be measured and compared with those caused by an equivalent static force.

Twenty-six specimens have been fabricated and are ready for test. Essential preliminary calculations and calibration tests have been made.

SUBSURFACE EXPLORATIONS

This new investigation has for its object the development of instruments and operating technic which will reveal subsurface formations of rock or other materials of concern in the construction of highways and highway structures.

At the outset of the work in September 1933, two independent scientific methods for sounding relatively shallow rock depths were considered as being probably most suitable. Both of the methods have been used extensively in mining and, to some extent, for shallower work. One involves the measurement of the electrical resistivity of the soil while the other, known as the seismic method, depends on the propagation and measurement of sound waves through the earth. As the first method mentioned is the simpler it was given first attention and a convenient and practical field apparatus has been designed, built, and given a considerable amount of use locally. Results to date justify the belief that this method of test can be used to advantage for determining the amount of rock excavation in highway construction, for locating dredging and quarry material, and for determining rock depths for bridges or other structures.

For the seismic tests a three-element oscillograph has been designed and is now under construction. It is believed that this method will be particularly useful in connection with bridge construction.

HIGHWAY-BRIDGE INVESTIGATIONS

Tests to determine the friction developed in the sliding of expansion bearings in highway bridges were described in the reports of the last 2 years. The originally scheduled tests in this investigation have been completed and a few additional tests involving other combinations of metals are now being made. The data which have been obtained are being analyzed and a detailed report is being prepared.

MEASUREMENT OF ROAD-SURFACE ROUGHNESS

The development of a standardized vehicle for use with the relative roughness indicator as described in last year's report has been continued. Because of certain difficulties encountered in the spring action of the single-wheel trailer, the development has been directed toward a means for satisfactorily damping the spring motion and considerable progress has already been made in this effort.

INVESTIGATION OF CONCRETE PAVEMENT DESIGN

Studies of the structural action of concrete-pavement slab and joint designs have been conducted actively throughout the year and the original program of tests is now practically complete. The scheduled tests to develop the efficiency of joint designs and of the relative balance of cross-sectional designs have been completed.

Advantage was taken of the unusual temperature conditions of the past winter to obtain data concerning the effects of subgrade freezing on the load resistance of pavement slabs. Valuable data on the magnitude and distribution of stresses due to restrained warping have also been obtained. Two of the five scheduled reports on this project are in practically final form and the others are in the course of preparation.

INVESTIGATIONS OF NONBITUMINOUS ROAD MATERIALS

PORTLAND CEMENT

During the year work was started on two laboratory investigations designed to develop information regarding the effect of variations in the chemical composition of portland cement on the durability of concrete. In one series a number of specially prepared cements differing widely in composition are being subjected

to an accelerated weathering test in combination with sands of both good and poor quality. In the other series, which is being conducted simultaneously in eight research laboratories under the sponsorship of the Highway Research Board, 11 brands of commercial portland cements differing in composition are being subjected to alternate freezing and thawing. This problem is of importance in connection with concrete for pavements and bridges, since in certain sections of the country structures are subjected to severe weathering and there is good evidence that the quality of the cement may affect the resistance of the concrete to weathering to a considerable extent.

AGGREGATES

Several investigations dealing with the methods of testing and the physical properties of stone, gravel, sand, etc., are being continued. These tests are being conducted, for the most part, in cooperation with various standardizing bodies, such as the American Association of State Highway Officials and the Highway Research Board. Additional information regarding the possibilities of the Los Angeles rattler test, referred to in the report of last year, was obtained and a report prepared for the use of the committee on materials of the American Association of State Highway Officials. Additional data were obtained in the development of improved laboratory methods of testing the soundness of aggregates. This work, conducted in cooperation with the American Association of State Highway Officials, contributed toward the adoption of two new tentative association standards covering methods of conducting soundness tests of aggregates.

CONCRETE

The promising results indicated by the series of tests to determine the effect of finishing pavement concrete by vibration led to a decision to continue this investigation during the coming year. In this work the latest types of vibrating equipment are being studied. As a result of the work done already along this line, a marked interest has been developed in this method of finishing which, from present indications, may eventually displace the methods now in use.

The study of methods for curing concrete has been temporarily delayed owing to the pressure of other work. However, the necessary equipment has been constructed and the tests will be conducted during the coming year. Tests of lightweight aggregates have been completed and a report is now being prepared for publication. Further tests were also made in connection with the standardization of the flexure test used in the control of paving concrete. Certain variables which may affect the results were investigated.

Recent inspections of concrete specimens stored in Medicine Lake, S. Dak., to determine the effect of various surface treatments in protecting the concrete against alkali attack indicate that, insofar as specimens treated with water-gas and coal-gas tar are concerned, resistance to attack is increased by (1) lowering the water-cement ratio, (2) increasing the length of the moist-curing period, (3) treating the concrete after as short a drying period as possible subsequent to moist curing, and (4) by the use of a coal-tar seal coat following initial priming with water-gas tar.

JOINT FILLERS

A recent development in preformed joint fillers for concrete structures, particularly pavements, has been the introduction of the so-called "resilient type" to replace the conventional plastic fillers which have been in use for many years. The results of a laboratory investigation designed to compare the efficiency of various types of resilient fillers, such as cork, sponge rubber, fiber, etc., were published during the year. The major conclusions from this investigation are as follows:

Considering the essential features of the resilient types of filler, as determined by the tests described in the report, the different types studied may be rated as follows: Sponge rubber and cork, fiber, and asphalt-rubber.

The different samples of sponge-rubber filler exhibit a considerable range in physical characteristics, which warrants careful investigation of any particular material prior to use.

A compression test with three edges restrained is believed suitable for testing resilient expansion-joint fillers. Measurements of the recovery, extrusion, and applied load can be made in a single test.

INVESTIGATIONS OF BITUMINOUS MATERIALS AND BITUMINOUS PAVING MIXTURES

Several years ago the Bureau conducted an investigation of sheet-asphalt and asphaltic-concrete paving mixtures on a circular track or roadway at the Arlington Experiment Farm. The foundation for the experimental sections of bituminous pavement was a reinforced concrete base 13 feet wide and 180 feet in mean diameter. Two series of tests were made and involved a total of 60 test sections which were subjected to a traffic of heavy trucks. The test sections in the first series were subjected to 50,000 truck trips and the second series to 64,000. The observed performance under this traffic, as affected by the variables included in the various sections, furnished the data for a report which has been published during the past year.

Two of the experimental projects, built in cooperation with State highway departments for the study of low-cost bituminous-treated surfaces, are active at the present time. One of these is in South Carolina and the other in Nebraska. The project in South Carolina is for the study of bituminous surfacings of several types on bases of marl and sand-clay. In Nebraska the experiments are with mixed-in-place construction in the sand-hill area of the State, the mineral aggregate being the soil material of the area which is largely blow sand. Periodic inspections are made of both projects and records of maintenance costs and service behavior are being kept.

Mention has been made in previous reports of the cooperative effort of the Bureau, the State highway departments, and the asphalt industry to simplify the tests and standardize specifications for the liquid asphaltic materials which are used extensively in low-cost road construction. A review of the 1933 specifications of the State highway departments for materials of this character indicates substantial progress in obtaining acceptance of the provisional standard specifications which have been recommended. This work is being continued and another series of regional meetings will be held during the coming year for the further promotion of uniformity in the requirements of specifications.

The investigations of the weather-resisting properties of liquid asphaltic materials, undertaken 2 years ago, are being continued. In these studies the basic changes occurring in such materials, when exposed to atmospheric conditions, are determined and the results correlated with the results of various laboratory tests. The ultimate purpose is the development of methods of test which will insure the use of durable materials and thereby result in minimum maintenance costs. A report of the work done during the summer of 1932 has been published and the data obtained in 1933 are being assembled for publication. The investigation has been broadened to include a study of the weathering properties of bituminous mixtures subjected to atmospheric exposure and controlled traffic. For this purpose a small circular track, similar to the indoor track described in last year's report, has been constructed out of doors. This phase of the study includes asphaltic materials from different producing fields and refined by different manufacturing processes.

The studies of low-cost bituminous mixtures on the indoor circular track, described in last year's report, are being continued.

The laboratory study of the factors essential to the proper design of hot bituminous paving mixtures is being continued. The work consists largely of making stability tests. A future phase of this investigation will be a correlation of the service behavior of bituminous pavements with the results of the stability tests.

SUBGRADE INVESTIGATIONS

Subgrade investigations have formerly been directed toward the establishment of the fundamental relationships of the physical phenomena observed when soils are subjected to load and variable climatic conditions. During the past year the work has taken on a somewhat more practical aspect in that it has been directed mainly toward the preparation of available information in such form as to make it more readily usable by the highway engineer, and the development of apparatus and procedures for attacking particular problems of highway construction.

The routine procedures for testing subgrade soils, referred to in last year's report, have been recommended to the American Association of State Highway Officials and the American Society for Testing Materials for adoption as tentative standards and, if accepted, will become a uniform basis for the formulation of specifications throughout the country.

Reports on hydraulic-fill settlement and on frost heave in highways and its prevention, which show the value and application of subgrade information in

practice, have been published. Continued investigation of the mechanical device for determining the liquid limit of soils has indicated its suitability for standardizing the liquid-limit test in various laboratories, as well as for revealing information of a character not furnished by any other test. A procedure for determining the centrifuge-moisture equivalent, which will eliminate the relatively expensive centrifuge, is being investigated and appears promising at the present time.

A standard procedure for performing the flocculation test has been established. This test has proved particularly valuable in differentiating between the good and poor varieties of limerocks, caliches, etc.

Continued research on the hydrometer method of mechanical analysis of fine-grained materials has led to the publication of two reports, the first dealing with the accuracy of the method, and the second detailing a procedure for making the mechanical analysis of portland cement. In addition, progress has been made in the development of a method for rapid mechanical analysis suitable for control purposes in the field. This method will eliminate the use of sieves and scales to a large extent.

A report describing a procedure for selecting soils suitable for use in mudjacking operations has been published and further investigations of this process may furnish additional information of practical value.

The combined compression and permeability apparatus as proposed by Charles Terzaghi, has proved valuable in the investigation of special problems relating to the behavior of soils under load and in the presence of water. Recent investigations of the expansive action of soils on absorbing water indicate a possible solution of the problem of warping of concrete pavements. These investigations will be continued on an enlarged scale.

A series of admixture tests has confirmed the statement previously made that certain simple tests were satisfactory for indicating the presence of the various soil constituents. A project has been inaugurated to determine the stability requirements of soils used in various parts of the highway structure and to investigate means of increasing the stability by admixture and manipulation. The apparatus used in these tests will include the drainage indicator and soil consolidator. The material tested will include the coarse as well as the fine fractions of soil. Since the purpose of the investigation is to furnish practical information regarding the construction of low-cost roads, base courses, earth fills, and the like, the results of the research will ultimately be carried to the field for demonstration.

Observations of the Virginia demonstration road have been continued and a progress report is in preparation.

Cooperation with the State highway departments in the making of subgrade surveys, in the design of subgrade treatments and road surfaces, and in the establishment of soil laboratories, has continued as in past years.

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REPORT OF THE CHIEF OF THE BUREAU OF PUBLIC ROADS, 1935

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF PUBLIC ROADS,
Washington, D. C., September 1, 1935.

HON. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I submit herewith the report of the Bureau of Public Roads for the fiscal year ended June 30, 1935.

Sincerely yours,

THOMAS H. MACDONALD, *Chief.*

Road construction work supervised by the Bureau of Public Roads during the fiscal year 1935 continued at the high volume of the preceding year that far exceeded the amount in any previous year. Work was done almost entirely with the grant of $400,000,000 under authority of the National Industrial Recovery Act of June 1933 and the grant of $200,000,000 under the Hayden-Cartwright Act of June 1934, but small amounts were available from Federal-aid and emergency authorizations of previous years.

The year began with the volume of road construction with Federal funds and employment at an all-time peak, made possible by the funds provided under the National Recovery Act. Construction activity continued large in volume through the fall months, and many projects were brought to completion. With the beginning of the construction season of 1935 work began in considerable amount on projects carried on with Hayden-Cartwright funds but not in sufficient volume to equal the record in the same months of the preceding year, as there was a decrease in the funds available.

The roads built have been constructed under conditions similar to those prevailing last year. They consist of sections on the Federal-aid highway system, extensions of the system into and through cities, and important secondary or feeder roads and sections of main highways through the national forests, parks, and public lands.

In all the work the primary motive has been to increase employment, and other considerations have been of secondary importance.

EMPLOYMENT ON ROAD WORK

Efforts to increase employment through the use of Federal funds for road construction began in 1930 when Federal aid for the fiscal year 1931 was increased from the $75,000,000 previously authorized to $125,000,000, and a like amount was authorized for each of the fiscal years 1932 and 1933. Subsequently emergency funds of $80,000,000 and $120,000,000 were advanced to the States and were used largely in matching Federal-aid funds.

The suitability of road work as a relief measure and the magnitude of the employment problem were recognized in the National Recovery Act of June 16, 1933, under which $400,000,000 was authorized as a direct grant to the States and $50,000,000 was authorized for roads in federally controlled areas.

The employment produced by these various acts is shown in table 1. Each year shows an increase in employment over the preceding year, and winter employment has been furnished on a scale considered impossible of attainment a few years before.

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U. S. DEPARTMENT OF AGRICULTURE
DEC 30 1935

TABLE 1.—*Comparison of employment during the fiscal years 1932, 1933, 1934, and 1935 on all Federal and Federal-aid highway construction and on all Federal and State road work, including State maintenance, by months*

Month	Men employed on all Federal and Federal-aid highway construction				Total men employed on all Federal and State highway construction and maintenance			
	1932	1933	1934	1935	1932	1933	1934	1935
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
July	164,708	81,042	129,205	335,223	385,349	305,372	332,277	549,203
August	151,418	89,346	111,211	297,224	389,949	333,403	329,813	531,034
September	116,100	122,193	115,047	247,880	356,617	374,405	337,973	498,151
October	88,869	124,106	154,016	210,079	330,104	373,246	384,029	450,322
November	62,466	129,933	185,860	201,046	289,316	371,667	420,069	426,603
December	35,991	98,271	174,358	147,101	244,971	290,465	362,031	323,700
January	29,518	75,498	154,154	96,594	229,189	266,443	315,989	240,414
February	26,673	78,215	156,814	81,257	218,218	255,256	306,090	221,406
March	28,008	95,704	144,053	90,999	211,549	279,213	296,265	217,539
April	42,205	122,256	187,657	123,063	245,843	299,882	345,278	282,740
May	59,008	139,831	271,972	167,535	259,615	330,138	466,504	331,000
June	71,772	152,276	336,414	193,263	280,636	359,605	545,013	362,339
Total (man-months)	876,736	1,308,671	2,120,761	2,191,264	3,441,356	3,839,095	4,441,331	4,434,451

The preceding fiscal year closed with 336,414 man-months of direct-job employment in June on work involving Federal funds—the largest employment yet recorded in any single month. With the beginning of the fiscal year 1935 there began a gradual decline in employment, resulting from the completion of projects under the program planned under the National Recovery Act.

The Hayden-Cartwright Act of June 18, 1934, had provided $200,000,000 as a direct grant to the States on substantially the same terms as the National Recovery Act, and also $24,000,000 for roads in national forests, national parks, and other areas under Federal control. These authorizations were not immediately reflected in employment on new projects since it was necessary for each State to prepare a program, make surveys, and prepare plans. Employment during the first 5 months of the year, although declining, far surpassed that of any similar period in past years. It was not until December that employment dropped below that of the same month of the preceding year. This decline continued through February, but in March new projects financed with Hayden-Cartwright funds reversed the trend, and direct employment climbed to 193,263 men at the close of the year. This is considerably below the 336,414 men employed in June 1934, and resulted from the decrease in funds available.

The average full-time employment was 182,605 men throughout the year. The number of men actually employed was somewhat greater than this, as contractors' pay rolls, because of labor turn-over, show about one-third more names than are reported as being required for normal operation. Therefore approximately 244,000 men were given direct-job employment in road work in the average month. To this should be added the indirect employment supplied in the production and transportation of materials and equipment. It is estimated that such indirect employment required by the work done has averaged approximately 1.4 times the direct employment, and on this basis the indirect employment afforded during the fiscal year 1935 is estimated at 3,067,800 man-months, which, added to the direct employment, results in a total of approximately 5,259,000 man-months for the year.

Table 1 also shows that Federal and Federal-aid road-construction employment supervised by the Bureau continues as a large proportion of the total employment afforded by all Federal and State highway construction and maintenance work since 1932, increasing from about one-fourth of the program in 1932 to one-third in 1933 and nearly one-half for the past 2 years.

Table 2 gives details of the 1935 Federal and Federal-aid employment by months, segregating the numbers of workers employed on the various classes of Federal and Federal-aid work supervised by the Bureau, and giving separately the numbers employed on independent State construction and maintenance. The total figures were affected by the decrease in State maintenance employment and by the drop in Federal road construction due to the partial completion of the Public Works highway program.

TABLE 2.—*Direct job employment of men during the fiscal year 1935 on the several classes of Federal and Federal-aid road construction and State road construction and maintenance*

Month	Men employed on road construction—													Men employed on road maintenance by State highway departments	Total men employed on Federal and State road construction and maintenance
	In whole or in part with Federal funds—												With State funds only, on State highways		
	Without Public Works funds				With Public Works funds, acts of June 16, 1933, and June 18, 1934										
	National-forest highways	National-park highways	Public-lands highways	Federal-aid highways	On Federal-aid system outside of municipalities	On extensions of Federal-aid system into municipalities	On secondary or feeder roads	National-forest highways	National-park highways	Public-lands highways	Loan-and-grant highways	National work-relief highways			
July	1,067	474	----------	3,489	127,669	71,623	75,634	6,550	6,038	1,040	10,679	30,960	45,478	168,502	549,203
August	689	568	----------	2,676	109,269	62,388	65,061	6,601	6,212	1,152	13,044	29,564	53,540	180,270	531,034
September	501	581	----------	1,936	86,536	48,639	54,101	6,009	6,168	1,149	14,683	27,577	61,865	188,406	498,151
October	956	396	100	1,459	73,632	34,539	49,630	5,091	5,812	1,249	14,670	22,545	71,008	169,235	450,322
November	1,454	333	228	2,008	69,299	29,196	47,957	3,325	4,875	650	16,346	25,375	66,106	159,451	426,603
December	1,354	113	178	1,512	50,962	18,624	36,941	1,341	2,341	593	11,276	21,866	41,919	134,680	323,700
January	961	83	126	626	35,620	10,861	21,421	697	1,428	457	6,448	17,866	23,537	120,283	240,414
February	678	110	134	307	30,526	9,612	15,614	415	913	338	3,561	19,049	17,940	122,209	221,406
March	758	111	125	412	34,305	11,765	17,539	505	854	168	3,960	20,497	18,391	108,149	217,539
April	1,193	140	179	449	46,532	18,038	25,785	706	1,312	51	8,083	20,595	24,193	135,484	282,740
May	1,864	154	308	1,067	65,692	25,768	37,869	961	2,535	130	12,176	19,011	27,924	135,541	331,000
June	2,880	548	480	880	76,906	31,517	46,654	1,352	3,251	183	12,485	16,127	30,823	138,253	362,339

CLASSES OF WORK SUPERVISED BY THE BUREAU

The road construction work supervised by the Bureau during the fiscal year was of several classes supported by funds appropriated by a number of different acts.

The major portion of the program was financed by funds authorized as direct grants to the States by the National Industrial Recovery Act for improvements on the Federal-aid highway system and its municipal extensions and on secondary or feeder roads and by the authorization in the Hayden-Cartwright Act made for similar purposes.

A relatively small part of the program was provided for by the unexpended balances of Federal-aid appropriations authorized over a period of years ended with the fiscal year 1933, and the emergency authorization of 1932. As in the preceding fiscal year, no Federal aid was provided for 1935, but the policy of Federal aid was resumed by an authorization in the Hayden-Cartwright Act for the fiscal years 1936 and 1937, and an apportionment to the States for 1936 has been made.

Other work in special areas for which the Federal Government was responsible consisted of: (1) The improvement of national-forest highways and (2) the improvement of highways through the public lands of the United States, both of which classes were under the supervision of the Department; and (3) the improvement of national-park highways. The national-park highways were constructed with appropriations made to the Interior Department, but under an interdepartmental agreement were supervised by the Bureau of Public Roads. The three classes of work were supported mainly by appropriations made in the National Industrial Recovery Act and the Hayden-Cartwright Act.

Another class of road work, an outgrowth of the recovery legislation, begun last year and expanded during the current year, consisted of projects financed under the loan-and-grant provisions of the National Industrial Recovery Act, which, after approval by the Public Works Administration, were placed by that body under the supervision of the Bureau of Public Roads.

Supervision of work-relief construction in cooperation with the State highway departments, begun in the preceding year, was continued on an enlarged scale. The workers on these projects were selected and paid by the Federal Emergency Relief Administration, and funds for materials and equipment were provided by the Public Works Administration.

The year's program included also an inconsequential volume of improvement under several appropriations for the reconstruction of roads damaged in several States.

The year's activities in connection with each of these classes of work are reported separately hereafter.

Under the Emergency Relief Appropriation Act of April 8, 1935, funds were allocated for highway improvement and the elimination of hazards at grade crossings by direct grants to the States. In this work even greater emphasis than in the past is to be laid on the selection of projects so as to provide the greatest employment of labor. Administrative procedure to attain this end was being developed at the close of the year.

ALL CLASSES OF WORK ADMINISTERED WITH EMPLOYMENT AS PRINCIPAL OBJECTIVE

To carry forward the paramount work-relief purpose of the different recovery acts, conditions were imposed in the preceding year by rules and regulations, issued with the approval of the Special Board for Public Works, for the administration of public-works appropriations that had the effect of increasing employment and of distributing the benefits of the expenditure over a wide area closely related to the need for employment. These policies were continued with some changes in procedure resulting from experience in 1934.

Human labor instead of machinery was used where practicable and to the public advantage. However, machine methods were used on certain classes of work, and an effort was made to avoid serious jeopardy to the effective road-machinery industry. The approval of varied types of construction maintained a desirable balance between labor directly employed at the site of the work and men employed in materials, equipment, and transportation industries.

On work of the lower types, encouraged on the secondary and feeder roads where traffic density would permit, the direct local employment formed a large part of the total. In the higher types of improvement, approved for main rural roads and streets in cities, the element of indirect employment was greater.

On extensions of Federal-aid highways across cities reasonable minimum expenditures were required, thereby increasing work-relief opportunities in centers where unemployment was concentrated. The requirement that not less than 25

percent of the funds be used on secondary or feeder roads insured large rural employment.

An increase in the number of individuals employed resulted from the limitation of hours of work; and by an increase in hourly wage an effort was made to compensate individuals for the reduction of their hours of work. This result was accomplished by requiring the various State highway departments to establish minimum-wage rates sufficient to provide a standard of living in decency and comfort considering the reduced hours of work and the other conditions existing.

ADMINISTRATIVE CHANGES MADE BY THE HAYDEN-CARTWRIGHT ACT

The Hayden-Cartwright Act of June 18, 1934, altered the procedure for the public-works highway construction administered by the Bureau in some respects, and, in providing funds for the resumption of the policy of Federal aid in 1936 and 1937, made certain changes in policy as a result of the changed conditions of the last few years.

The importance of increased provision for secondary roads and of employment in rural areas was recognized by a requirement that not less than 25 percent of the funds provided by the act for the year 1935 should be expended on secondary roads. In the preceding year it had been required that not more than 25 percent should be expended on such roads.

To provide a program of projects for immediate construction, the rules and regulations issued by the Secretary of Agriculture with the approval of the Special Board for Public Works on July 7, 1934, required that initial programs be prepared by the several States consisting of approximately 25 percent of the apportionment under the Hayden-Cartwright Act, priority being given to projects in the following order: (1) The closing of gaps in the Federal-aid highway system; (2) the elimination of traffic hazards, particularly those caused by railroad grade crossings; (3) the improvement of those projects of particular use to other Government agencies; (4) road construction correlating and supplementing other existing transportation facilities; (5) the improvement of roadsides, involving not less than 1 percent of the total apportionment of each State; (6) reconstruction designed to reduce maintenance costs and decrease future expenditures; and (7) to provide a large number of small projects to employ the maximum of human labor. A substantial program of railroad grade-crossing elimination was required in each State.

Important changes were made in provisions applying to Federal aid to be resumed in the fiscal year 1936. Federal-aid funds have heretofore been limited in application to the Federal-aid system in rural and suburban areas and have not been available for use in the built-up portion of cities. With the initial improvement of the system nearing completion, the movement of traffic through cities has become an important problem, and the restriction on municipal improvements has been removed.

In many instances proper development of heavy-traffic routes on the Federal-aid system routes requiring wide, high-type, costly surfaces has been made difficult by the restriction of Federal participation to $15,000 per mile. This restriction has been removed, and participation is possible up to 50 percent of the cost. This change will be particularly helpful where additional width is required and an amount close to $15,000 has already been spent on the initial improvement.

In the last few years funds available to the States for road purposes have been considerably depleted by the diversion of motor-vehicle revenues and gasoline taxes to other purposes. The Hayden-Cartwright Act states the principle that it is unfair to tax highway transportation for purposes other than highway improvement and imposes on the Secretary of Agriculture the duty of withholding not more than one-third of Federal-aid apportionments to any State that applies to highway purposes a lesser amount of motor-vehicle fees and gasoline taxes than was legally required on June 18, 1934.

The occasional need of the States for funds with which to plan projects for future road construction and the generally recognized need for more complete information regarding the present condition of our complete highway system, the use being made of it, and the extent to which further improvements should be made led to the authorization that as much as 1½ percent of the $200,000,000 provided for 1935 and of Federal-aid funds for the fiscal years 1936 and 1937 may be used for planning surveys.

At the close of the year, survey plans to give a clearer picture of our highway situation than has heretofore existed were being developed. The work is to be done in cooperation with the States and much of the data will be collected by white-collar workers taken from relief rolls.

NATIONAL DEFENSE ROADS

A War Department study of highways, based on a previous collaboration of the Bureau with the War Department General Staff, established national defense highway priorities of improvement that will hereafter be considered by the Bureau in approving road programs involving the use of Federal funds. Some of the War Department recommendations with respect to these highways were as follows: (1) That certain roads selected by the War Department be at least two lanes wide with a minimum overhead clearance of 14 feet at all structures; (2) that bridges on major priority roads be designed for at least an H–15 loading as specified by the American Association of State Highway Officials and on minor priority roads for an H–10 loading as specified by the association;[1] and (3) that road surfaces be suitable to serve traffic comparable to that for which the bridges were designed under all weather conditions.

THE EMERGENCY RELIEF APPROPRIATION ACT OF 1935

The Emergency Relief Appropriation Act of April 8, 1935, authorized the allocation of not to exceed $800,000,000 for highways, roads, streets, and grade-crossing elimination. Under this authorization $200,000,000 was allocated for highways, $200,000,000 for grade-crossing work and $100,000,000 was provided as the unappropriated balance of the $200,000,000 authorized by the Hayden-Cartwright Act.

The funds for highways and grade crossings were apportioned by the Secretary of Agriculture on June 3, 1935; those for highways on the basis provided in the National Recovery Act; and, those for grade crossings one-fourth in proportion to mileage of the Federal-aid system, one-fourth in proportion to mileage of railroads, and one-half in proportion to population.

A great many grade crossings have been eliminated in past years with funds administered by the Bureau. However, the amount of work done has been far below the need. For the first time a major attack on this problem was possible.

As the year closed, rules and regulations for the expenditure of both funds were being prepared. These regulations contemplated wide diffusion of the funds, the requirement of a man-year of employment for each $1,400 of highway funds expended, and the fixing of minimum wage limits by the States with the approval of the Department.

HIGHWAY SAFETY

The increasing number of highway accidents is a matter of grave concern to all in positions of responsibility for highway construction or the use of highways. The Bureau has contributed to the solution of this problem by activity in several directions. In approval of plans for highway construction it has constantly endeavored to effect a desirable widening of surfaces, straightening of alinement and reduction of grades to make the roads suitable for the increased speed of modern traffic. The desirability of eliminating dangerous grade crossings, of adequate road marking, and of provision of footpaths and walks for pedestrians has also been strongly urged upon the States.

A manual for signs and markers has been prepared by the Bureau in cooperation with the American Association of State Highway Officials and other agencies and is now used as a standard throughout the country. Participating in the work of the National Conference on Street and Highway Safety, it has contributed to the preparation of, and has published, five codes relating to motor-vehicle registration and regulation proposed for uniform adoption by the States. Uniformity in regulation of motor vehicles must be one of the most important steps in promoting highway safety.

Special safety studies have been made in Rhode Island, South Carolina, and four cities of Tennessee in cooperation with local authorites and the Federal Emergency Relief Administration.

STATUS OF MAJOR APPROPRIATIONS

Appropriations of several general types supported the greater part of the Bureau's work during the year. The major types were as follows:

(1) Federal-aid appropriations made under authorizations for fiscal years up to 1933. These appropriations must be matched with State or other funds, and

[1] The H–15 loading or heavier loading is used by practically all of the State highway departments in the design of bridges for primary roads. The H–10 loading is used in designing bridges for secondary roads.

when so matched are available for expenditure only on the approved Federal-aid highway system. These funds represented only a small portion of the year's program, and all such funds were obligated at the end of the fiscal year.

(2) Emergency relief funds appropriated by the act of 1932. These funds were available to the States to be used, in lieu of State funds, for the purpose of matching Federal-aid appropriations. They could also be used in conjunction with National Recovery funds.

(3) The appropriation made by section 204 of the National Industrial Recovery Act for the improvement of the Federal-aid system and its municipal extensions and secondary or feeder roads. This money was available for payment of the entire cost of improvements except expenses for right-of-way, and could be used in conjunction with Federal-aid funds or emergency-construction funds or both.

(4) The appropriation made by the Hayden-Cartwright Act providing for the emergency construction of public highways and related projects in accordance with the provisions of section 204 of the National Recovery Act as amended. The same act set up a fund of $10,000,000 to be used in the repair of roads and bridges on the Federal-aid system damaged by floods, hurricanes, earthquakes, and landslides.

(5) The appropriation made by the Emergency Relief Appropriation Act of 1935 became available at the end of the year, but did not affect construction during the year.

Other appropriations more limited in scope and application were made for forest-highway construction and road building on Federal public lands.

FEDERAL-AID FUNDS

No Federal-aid funds were authorized for the fiscal year 1935. In the 3 years from 1931 to 1933, inclusive, they were authorized at the rate of $125,000,000 a year, but the last authorization was subject to reduction in the amount of one-fifth of the amount actually expended of the emergency funds provided by the act of December 20, 1930. The amount so deducted was $15,840,743.86. The Hayden-Cartwright Act provides that no further deductions are to be made as reimbursement for emergency advances of 1930 and 1932.

Table 3 gives for the fiscal years 1923 to 1933, inclusive, the amounts of the Federal-aid funds apportioned among the States after deducting the percentage allowable for Federal administration, and, for the same period of years with addition of 1934 and 1935, the amounts obligated to definite projects and amounts paid for work done during each of the years. It will be observed that the maximum rate of obligation and expenditure of these funds was reached in the fiscal year 1931, with recession in later years as the unobligated and unexpended balances were reduced and other funds became available. As shown by this table, the amount of Federal-aid funds paid to the States in the fiscal year 1935 was $12,657,267.

TABLE 3.—*Federal-aid funds apportioned to the States, obligated to projects, and paid to the States each fiscal year from 1923 to 1935, inclusive*

Fiscal year	Apportioned amount of appropriation authorized for the year	Amount of Federal-aid funds obligated during the year	Amount of Federal-aid funds paid to States during the year
1923	$48,750,000.00	$77,461,559	$69,677,241.86
1924	63,375,000.00	89,866,864	79,217,397.90
1925	73,125,000.00	87,294,396	95,749,998.11
1926	73,125,000.00	79,608,897	87,754,534.57
1927	73,125,000.00	77,453,046	81,371,013.03
1928	73,125,000.00	88,922,185	80,802,232.55
1929	73,125,000.00	70,428,896	82,097,380.38
1930	73,125,000.00	102,498,084	75,880,862.84
1931	121,875,000.00	157,952,903	133,340,910.64
1932	121,875,000.00	83,793,787	127,367,119.74
1933	106,034,256.14	46,689,026	101,266,331.02
1934		12,847,071	42,291,936.73
1935		2,343,260	12,657,266.66
Total	900,659,256.14	977,159,974	1,069,474,226.03
Average	[1] 81,878,114.19	75,166,152	82,267,248.15

[1] Average for 11 years. No Federal-aid funds were authorized for the fiscal years 1934 and 1935.

Details of this expenditure are given by States in table 4, which also shows the status of the unexpended funds at the close of the fiscal year. All of the authorized funds were at that time obligated. There was an unpaid balance of $4,158,667; but of this sum a portion was already earned by the completion of work for which it was allotted, and the unearned balance was only approximately $2,147,000 at the end of the year.

TABLE 4.—*Federal aid paid to States during the fiscal year 1935, and unpaid and unearned balances of the total Federal-aid apportionment on June 30, 1935*

State	Paid to States	Unpaid balance	Unearned balance
Alabama	$1,699,369.02	$343,760.02	$214,000
Arizona	52,330.41	7,453.63	
Arkansas	513,796.00	134,619.99	71,000
California	28,547.56	8,238.65	
Colorado	167,904.89	43,568.05	29,000
Connecticut	271,644.57	202,677.39	113,000
Delaware	5,270.48		
Florida	330,051.51	64,285.79	20,000
Georgia	118,649.70	65,808.87	63,000
Idaho	72,798.38	29,913.49	9,000
Illinois	627,295.10	238,107.83	71,000
Indiana	141,039.68	147,146.87	67,000
Iowa			
Kansas	113,490.85		
Kentucky	25,173.97	17,329.69	8,000
Louisiana	124,285.64	127,068.51	113,000
Maine	172.41		
Maryland	6,123.96		
Massachusetts	325,243.77	43,859.64	10,000
Michigan	135,831.76	32,983.99	1,000
Minnesota	118,281.00	59,637.47	
Mississippi	1,595,857.68	491,873.71	353,000
Missouri	128,371.09	3,430.87	
Montana	414,065.51	49,839.01	25,000
Nebraska	151,237.92		
Nevada	43,327.07		
New Hampshire	44,660.77	1,781.13	1,000
New Jersey	693,237.16	119,884.33	
New Mexico	153,083.82	14,844.50	
New York	996,661.69	200,681.95	60,000
North Carolina	599,476.47	216,675.77	152,000
North Dakota	439,153.24	308,676.39	168,000
Ohio	117,103.84	135,253.23	71,000
Oklahoma	44,148.28	153,361.80	153,000
Oregon	251,107.17	33,236.17	2,000
Pennsylvania	54,240.81	104,907.39	1,000
Rhode Island	62,867.28		
South Carolina	84,011.38	21,309.39	8,000
South Dakota	476,774.85	78,279.89	32,000
Tennessee	203,809.39	14,014.71	1,000
Texas	146,299.91	149,836.16	103,000
Utah	207,799.55	41,912.91	30,000
Vermont	6,553.48		
Virginia	311,007.22	297,927.28	162,000
Washington	16,168.04		
West Virginia	64,564.16	10,611.24	10,000
Wisconsin	63,232.16	3,257.98	
Wyoming	94,398.04	48,874.57	1,000
Hawaii	316,748.02	91,736.56	25,000
Total	12,657,266.66	4,158,666.82	2,147,000

By the Hayden-Cartwright Act, approved June 18, 1934, additional Federal-aid appropriations were authorized to be made in the amount of $125,000,000 for each of the fiscal years 1936 and 1937. In accordance with the requirements of the Federal Highway Act, as amended, the first of these sums was apportioned on December 27, 1934, for construction work in the fiscal year 1936.

EMERGENCY-CONSTRUCTION FUNDS

The amount appropriated by the Emergency Relief and Construction Act of 1932 was $120,000,000. The entire sum, without deduction for Federal administrative purposes, was apportioned among the several States and Hawaii as shown by table 5. These sums have since been expended in conjunction with Federal-aid apportionments, State funds, and apportionments under the Recovery Act, the total expenditure to June 30, 1935, being $119,936,769, as detailed in table 5. Of the total payments to that date, only $2,135,663 was expended during the fiscal year 1935.

TABLE 5.—*Emergency-construction apportionment, and amounts paid to States for the fiscal year 1935, and the total paid to June 30, 1935*

State	Emergency-construction apportionment	Paid to States during fiscal year	Total paid to States
Alabama	$2,558,229	$98,747.12	$2,558,229.00
Arizona	1,760,771		1,760,771.00
Arkansas	2,101,182	198,704.63	2,101,182.00
California	4,667,188		4,667,188.00
Colorado	2,258,613	6,147.07	2,258,613.00
Connecticut	778,806		778,806.00
Delaware	600,000		600,000.00
Florida	1,624,752	18,259.64	1,624,752.00
Georgia	3,123,298		3,123,298.00
Idaho	1,505,912	42,339.53	1,505,912.00
Illinois	5,082,847		5,047,271.14
Indiana	3,058,980		3,058,980.00
Iowa	3,171,504		3,171,504.00
Kansas	3,265,048		3,265,048.00
Kentucky	2,264,637		2,264,637.00
Louisiana	1,745,559		1,745,569.00
Maine	1,067,079		1,067,079.00
Maryland	1,019,570	7,311.54	1,019,570.00
Massachusetts	1,716,612		1,716,612.00
Michigan	3,779,706	37,947.53	3,779,706.00
Minnesota	3,368,559		3,368,559.00
Mississippi	2,160,164	49,886.79	2,160,164.00
Missouri	3,753,453		3,753,453.00
Montana	2,525,071	.01	2,525,071.00
Nebraska	2,544,773		2,544,773.00
Nevada	1,575,756		1,575,756.00
New Hampshire	600,000	14,229.09	600,000.00
New Jersey	1,657,733	531,233.35	1,657,733.00
New Mexico	1,965,473		1,965,473.00
New York	6,059,238	128,014.47	6,031,583.32
North Carolina	2,888,251	37,559.60	2,888,251.00
North Dakota	1,933,901	153.55	1,933,901.00
Ohio	4,490,175	129,793.34	4,490,175.00
Oklahoma	2,888,723	26,047.13	2,888,723.00
Oregon	2,001,740	107,479.19	2,001,740.00
Pennsylvania	5,267,060		5,267,060.00
Rhode Island	600,000		600,000.00
South Carolina	1,666,755	88,473.71	1,666,755.00
South Dakota	2,004,573	57,283.61	2,004,573.00
Tennessee	2,605,160	54,721.42	2,605,160.00
Texas	7,664,621		7,664,621.00
Utah	1,395,331	126,374.98	1,395,331.00
Vermont	600,000		600,000.00
Virginia	2,256,178	308,467.62	2,256,178.00
Washington	1,920,470		1,920,470.00
West Virginia	1,323,912	54,523.46	1,323,912.00
Wisconsin	2,991,076	4,371.82	2,991,076.00
Wyoming	1,541,561		1,541,561.00
Hawaii	600,000	7,592.68	600,000.00
Total	120,000,000	2,135,662.88	119,936,769.46

PUBLIC WORKS HIGHWAY FUNDS

The public works highway program was initiated by the National Industrial Recovery Act of June 16, 1933 under which the President allocated $400,000,000 for highways. It was provided that work be done in accordance with the Federal Highway Act with the exception that extensions of the Federal-aid system into and through cities, and secondary roads, formerly ineligible for improvement, were included in the program.

Construction work financed with these funds had reached a peak at the close of the last fiscal year, with the prospect that a large part of the program would be completed and employment correspondingly decline during the fall months of 1934. In anticipation of the depletion of National Recovery funds, the Hayden-Cartwright Act of June 18, 1934, authorized an additional $200,000,000 to be expended under the same general plan. Rules and regulations applying to new projects under both of the above-mentioned funds were issued on July 13, 1934. The new regulations differed from those formerly used where the experience of the previous year showed changes to be desirable, but the changes were not such as to alter the general character of the program. The most significant change, required

by the act, and applying only to the new funds, was that not less than 25 percent of the funds should be applied to secondary roads, whereas not more than 25 percent of the first authorization could be applied to roads of that class.

State programs showing types and locations of proposed improvements grouped according to the three classes of improvements contemplated—Federal-aid system, extensions of the system into and through municipalities, and secondary roads—were submitted and approved without undue delay. The apportionment of funds and assignments to classes of projects are shown in table 6.

TABLE 6.—*Apportionment and assignment of 1935 Public Works highway funds, June 30, 1935, as provided by the act of June 18, 1934*

State	Apportionment	Assignment of apportioned funds—					
		To projects on the Federal-aid system outside of municipalities		To projects on extensions of the Federal-aid system into and through municipalities		To projects on secondary or feeder roads	
	Dollars	*Dollars*	*Percent*	*Dollars*	*Percent*	*Dollars*	*Percent*
Alabama	4,259.842	2,129,921.00	50.0	1,064,960.50	25.0	1,064,960.50	25.0
Arizona	2,641,935	1,338,712.23	50.7	305,191.25	11.5	998,031.52	37.8
Arkansas	3,428,049	1,714,000.00	50.0	857,025.00	25.0	857,024.00	25.0
California	7,932,206	3,713,643.00	46.9	2,219,360.00	27.9	1,999,203.00	25.2
Colorado	3,486,006	2,424,504.00	69.6	190,000.00	5.4	871,502.00	25.0
Connecticut	1,454,868	607,500.00	41.8	426,500.00	29.3	420,868.00	28.9
Delaware	923,395	461,697.50	50.0	230,848.75	25.0	230,848.75	25.0
Florida	2,661,343	1,116,600.00	42.0	501,200.00	18.8	1,043,543.00	39.2
Georgia	5,113,491	2,556,745.00	50.0	1,278,373.00	25.0	1,278,373.00	25.0
Idaho	2,277,486	1,131,910.00	49.7	321,126.00	14.1	824,450.00	36.2
Illinois	8,921,401	2,408,778.00	27.0	2,230,350.00	25.0	4,282,273.00	48.0
Indiana	5,088,963	2,816,686.80	55.3	2,136,306.41	42.0	135,969.79	2.7
Iowa	5,118,361	2,217,361.00	43.3	1,311,000.00	25.6	1,590,000.00	31.1
Kansas	5,117,675	2,354,130.50	46.0	1,432,949.00	28.0	1,330,595.50	26.0
Kentucky	3,818,311	1,302,208.76	34.1	958,598.85	25.1	1,557,503.39	40.8
Louisiana	2,963,932	1,380,419.00	46.6	744,560.00	25.1	838,953.00	28.3
Maine	1,711,586	782,195.00	45.7	484,379.00	28.3	445,012.00	26.0
Maryland	1,810,058	289,609.28	16.0	452,514.50	25.0	1,067,934.22	59.0
Massachusetts	3,350,474	1,582,874.00	47.2	847,600.00	25.3	920,000.00	27.5
Michigan	6,452,568	3,226,284.00	50.0	1,613,142.00	25.0	1,613,142.00	25.0
Minnesota	5,425,551	2,533,732.38	46.7	1,421,494.30	26.2	1,470,224.32	27.1
Mississippi	3,540,227	2,832,181.60	80.0	354,022.70	10.0	354,022.70	10.0
Missouri	6,173,740	2,890,666.00	46.8	919,152.29	14.9	2,363,921.71	38.3
Montana	3,769,734	2,714,208.00	72.0	113,092.00	3.0	942,434.00	25.0
Nebraska	3,964,364	1,982,182.00	50.0	991,091.00	25.0	991,091.00	25.0
Nevada	2,302,356	1,350,356.00	58.7	100,000.00	4.3	852,000.00	37.0
New Hampshire	969,462	465,404.39	48.0	242,464.77	25.0	261,592.84	27.0
New Jersey	3,220,879	951,379.00	29.6	1,809,500.00	56.0	460,000.00	14.4
New Mexico	2,941,700	1,676,769.00	57.0	529,506.00	18.0	735,425.00	25.0
New York	11,227,921	3,748,600.00	33.1	3,756,621.00	33.2	3,822,700.00	33.7
North Carolina	4,840,941	1,930,365.00	39.9	1,210,236.00	25.0	1,700,340.00	35.1
North Dakota	2,938,967	1,469,483.50	50.0	734,741.75	25.0	734,741.75	25.0
Ohio	7,865,012	3,539,255.40	45.0	2,359,503.60	30.0	1,966,253.00	25.0
Oklahoma	4,685,180	2,342,590.00	50.0	1,171,295.00	25.0	1,171,295.00	25.0
Oregon	3,097,814	1,452,741.00	46.9	867,977.00	28.0	777,096.00	25.1
Pennsylvania	9,590,788	4,554,082.00	47.5	2,397,703.00	25.0	2,639,003.00	27.5
Rhode Island	1,014,572	474,772.00	47.0	285,760.07	28.0	254,039.93	25.0
South Carolina	2,770,954	940,954.00	34.0	488,000.00	17.6	1,342,000.00	48.4
South Dakota	3,047,643	1,523,821.50	50.0	761,910.75	25.0	761,910.75	25.0
Tennessee	4,302,991	2,105,453.50	48.9	1,121,789.75	26.1	1,075,747.75	25.0
Texas	12,291,253	6,858,253.00	55.8	1,795,000.00	14.6	3,638,000.00	29.6
Utah	2,132,691	1,066,345.50	50.0	533,172.75	25.0	533,172.75	25.0
Vermont	948,007	466,042.22	49.2	240,610.51	25.4	241,254.27	25.4
Virginia	3,765,387	1,916,178.16	50.9	956,020.53	25.4	893,188.31	23.7
Washington	3,106,412	1,553,206.00	50.0	776,603.00	25.0	776,603.00	25.0
West Virginia	2,280,335	1,140,167.00	50.0	570,085.00	25.0	570,083.00	25.0
Wisconsin	4,941,837	1,818,970.00	36.8	1,379,513.00	27.9	1,743,354.00	35.3
Wyoming	2,287,712	1,686,368.00	73.7	29,416.00	1.3	571,928.00	25.0
District of Columbia	973,842			181,051.07	18.6	792,790.93	81.4
Hawaii	949,778	598,778.00	63.0			351,000.00	37.0
Total	200,000,000	94,139,083.22	47.1	47,703,317.10	23.8	58,157,599.68	29.1

Projects financed with the new funds were placed under construction in the fall months of 1934 and increased to a large volume with the opening of the 1935 construction season. On June 30, 1935, there remained only $5,018,643 unobligated from 1934 funds and $28,241,383 from 1935 funds, as shown by tables 7 and 8, and the amounts obligated were divided among the three classes of projects in the several States as shown.

TABLE 7.—*Status of obligation of apportioned 1934 Public Works highway funds, as provided by sec. 204 of the National Industrial Recovery Act, as of June 30, 1935*

State	Total apportionment	Obligated to projects—			Balance unobligated
		On the Federal-aid system outside of municipalities	On extensions of the Federal-aid system into and through municipalities	On secondary or feeder roads	
Alabama	$8,370,133	$3,938,300.93	$2,366,921.07	$1,989,824.33	$75,086.67
Arizona	5,211,960	3,832,516.57	752,981.17	576,272.95	50,189.31
Arkansas	6,748,335	3,320,123.42	1,949,177.00	1,395,749.89	83,284.69
California	15,607,354	7,911,568.39	4,206,563.85	3,478,739.49	10,482.27
Colorado	6,874,530	3,437,265.00	1,691,030.53	1,718,632.00	27,602.47
Connecticut	2,865,740	1,403,217.56	802,407.00	659,120.00	995.44
Delaware	1,819,088	877,525.21	460,282.30	481,113.40	167.09
Florida	5,231,834	2,435,141.90	1,440,783.89	1,284,727.07	71,181.14
Georgia	10,091,185	4,906,398.58	2,508,673.57	2,225,582.09	450,530.76
Idaho	4,486,249	2,158,872.26	1,152,434.93	1,094,529.68	80,412.13
Illinois	17,570,770	4,398,271.90	7,372,059.36	5,772,761.93	27,676.81
Indiana	10,037,843	4,957,775.29	4,255,300.34	696,645.24	128,122.13
Iowa	10,055,660	5,027,830.00	2,614,433.23	2,412,650.83	745.94
Kansas	10,089,604	5,035,923.90	2,522,401.00	2,522,401.00	8,878.10
Kentucky	7,517,359	3,695,818.78	1,897,787.49	1,818,412.78	105,339.95
Louisiana	5,828,591	2,675,339.39	1,701,743.07	1,423,380.39	28,128.15
Maine	3,369,917	1,551,597.68	951,302.53	842,403.50	24,613.29
Maryland	3,564,527	1,695,373.73	646,473.56	891,102.08	331,577.63
Massachusetts	6,597,100	1,101,716.00	4,978,604.12	469,741.41	47,038.47
Michigan	12,736,227	5,997,341.23	3,481,531.06	3,148,167.22	109,187.49
Minnesota	10,656,569	4,478,513.42	3,663,878.72	2,344,284.06	169,892.80
Mississippi	6,978,675	3,421,093.27	1,671,170.59	1,709,381.43	177,029.71
Missouri	12,180,306	5,157,488.68	3,867,042.97	2,921,557.45	234,216.90
Montana	7,439,748	4,407,750.22	1,108,288.77	1,751,640.86	172,068.15
Nebraska	7,828,961	3,914,481.00	1,917,390.47	1,957,240.00	39,849.53
Nevada	4,545,917	2,905,727.57	473,901.01	1,134,166.80	32,121.62
New Hampshire	1,909,839	692,118.65	740,334.62	477,385.73	
New Jersey	6,346,039	3,138,919.21	3,010,962.24	55,098.73	141,058.82
New Mexico	5,792,935	2,846,648.00	1,595,456.19	1,272,129.00	78,701.81
New York	22,330,101	10,273,759.61	8,132,659.08	3,551,060.14	372,622.17
North Carolina	9,522,293	4,421,394.69	2,341,579.00	2,347,302.86	412,016.45
North Dakota	5,804,448	2,858,348.80	1,428,599.71	1,395,139.26	122,360.23
Ohio	15,484,592	7,269,116.38	4,331,665.58	3,804,002.44	79,807.60
Oklahoma	9,216,798	4,608,029.86	2,302,448.03	2,298,421.75	7,898.36
Oregon	6,106,896	3,023,562.66	1,491,183.47	1,520,866.38	71,283.49
Pennsylvania	18,891,004	6,634,762.26	4,789,914.06	7,326,867.91	139,459.77
Rhode Island	1,998,708	979,367.00	518,990.77	439,716.00	60,634.23
South Carolina	5,459,165	2,693,771.69	1,364,791.00	1,350,172.41	50,429.90
South Dakota	6,011,479	2,955,054.29	1,309,456.24	1,502,870.00	244,098.47
Tennessee	8,492,619	4,183,363.15	2,123,155.00	2,059,177.20	126,923.65
Texas	24,244,024	11,562,316.62	6,391,389.60	5,988,778.30	301,539.48
Utah	4,194,708	2,361,852.07	778,276.12	1,048,677.00	5,902.81
Vermont	1,867,573	921,854.08	487,129.24	438,631.41	19,958.27
Virginia	7,416,757	3,608,391.15	1,898,681.63	1,736,770.24	172,913.98
Washington	6,115,867	3,022,410.42	1,970,844.77	1,080,673.00	41,938.81
West Virginia	4,474,234	2,013,405.00	1,341,312.78	1,113,220.70	6,295.52
Wisconsin	9,724,881	4,691,114.92	2,572,507.70	2,416,978.30	44,280.08
Wyoming	4,501,327	2,246,419.91	1,118,858.53	1,122,741.51	13,307.05
District of Columbia	1,918,469		946,444.55	972,024.45	
Hawaii	1,871,062	1,674,551.35		177,717.69	18,792.96
Total	394,000,000	183,323,503.65	113,441,203.51	92,216,650.29	5,018,642.55

TABLE 8.—*Status of obligation of apportioned 1935 Public Works highway funds, as provided by the Hayden-Cartwright Act of June 18, 1934, as of June 30, 1935*

State	Total apportionment	Obligated to projects—			Balance unobligated
		On the Federal-aid system outside of municipalities	On extensions of the Federal-aid system into and through municipalities	On secondary or feeder roads	
Alabama	$4,259,842	$1,730,831.76	$515,691.15	$922,998.22	$1,090,320.87
Arizona	2,641,935	1,328,956.84	243,308.16	890,907.21	178,762.79
Arkansas	3,428,049	1,447,703.32	597,839.24	705,079.59	677,426.85
California	7,932,206	3,422,068.43	2,107,875.95	1,776,642.54	625,619.08
Colorado	3,486,006	2,415,213.35	169,410.60	871,502.00	29,880.05
Connecticut	1,454,868	554,725.61	286,496.07	235,769.00	377,877.32
Delaware	923,395	458,528.48	91,830.00	225,543.76	147,492.76
Florida	2,661,343	1,085,224.72	257,076.78	1,007,468.24	311,573.26
Georgia	5,113,491	1,814,344.77	584,658.11	501,535.86	2,212,952.26
Idaho	2,277,486	882,877.19	216,565.94	645,405.70	532,637.17
Illinois	8,921,401	2,408,778.00	1,629,851.62	3,999,583.61	883,187.77
Indiana	5,088,963	2,698,122.90	1,845,332.95	109,126.18	436,380.97
Iowa	5,118,361	2,086,648.60	1,025,235.00	1,589,875.00	416,602.40
Kansas	5,117,675	2,354,130.50	1,432,949.00	1,330,595.50	----------
Kentucky	3,818,311	1,223,831.01	678,496.75	1,516,907.79	399,075.45
Louisiana	2,963,932	1,140,713.29	607,523.18	820,647.53	395,048.00
Maine	1,711,586	780,542.75	477,471.72	437,259.15	16,312.38
Maryland	1,810,058	253,219.97	----------	595,765.90	961,072.13
Massachusetts	3,350,474	995,238.97	268,282.56	530,432.80	1,556,519.67
Michigan	6,452,568	3,011,161.48	1,516,000.00	1,613,142.00	312,264.52
Minnesota	5,425,551	2,387,270.15	738,320.07	1,380,456.60	919,504.18
Mississippi	3,540,227	2,498,515.11	233,200.36	205,413.11	603,098.42
Missouri	6,173,740	2,890,666.00	919,152.29	2,363,921.71	----------
Montana	3,769,734	2,671,621.92	72,142.80	886,999.42	138,969.86
Nebraska	3,964,364	1,926,812.54	852,565.53	924,940.64	260,045.29
Nevada	2,302,356	1,338,009.12	57,842.23	597,352.06	309,152.59
New Hampshire	969,462	441,404.39	232,399.42	249,411.61	46,246.58
New Jersey	3,220,879	600,774.15	749,388.92	107,524.70	1,763,191.23
New Mexico	2,941,700	1,676,769.00	249,529.20	719,271.01	296,130.79
New York	11,327,921	3,503,681.69	3,410,690.00	3,612,338.61	801,210.70
North Carolina	4,840,941	1,305,283.86	1,143,691.89	1,545,690.96	846,274.29
North Dakota	2,938,967	885,776.14	336,445.99	284,816.64	1,431,928.23
Ohio	7,865,012	2,946,033.00	1,888,317.24	1,519,992.91	1,510,668.85
Oklahoma	4,685,180	2,179,830.87	901,915.89	996,412.65	607,020.59
Oregon	3,097,814	1,383,798.86	775,726.37	777,096.00	161,192.77
Pennsylvania	9,590,788	4,357,459.16	1,766,369.87	2,501,400.28	965,558.69
Rhode Island	1,014,572	464,572.00	141,760.07	249,377.60	158,862.33
South Carolina	2,770,954	490,600.50	275,166.84	1,275,504.85	729,681.81
South Dakota	3,047,643	1,399,995.31	265,267.12	595,542.98	786,837.59
Tennessee	4,302,991	2,059,254.78	860,348.46	799,753.66	583,634.10
Texas	12,291,253	6,205,849.09	1,358,195.53	3,550,602.77	1,176,605.61
Utah	2,132,691	929,074.55	530,866.11	532,172.75	140,577.59
Vermont	948,007	456,585.01	213,220.57	240,451.45	37,749.97
Virginia	3,765,387	1,760,241.51	871,627.68	844,613.05	288,904.76
Washington	3,106,412	1,543,022.85	755,870.96	775,338.42	32,179.77
West Virginia	2,280,335	771,614.92	258,676.10	394,680.80	855,363.18
Wisconsin	4,941,837	1,775,710.73	1,356,431.36	1,623,472.57	186,222.34
Wyoming	2,287,712	1,641,416.00	16,916.00	550,850.91	78,529.09
District of Columbia	973,842	----------	181,051.07	504,116.38	288,674.55
Hawaii	949,778	273,416.37	----------	----------	676,361.63
Total	200,000,000	84,857,921.52	35,964,990.72	50,935,704.68	28,241,383.08

The amounts paid to the several States for work done under the National Industrial Recovery Act, described as 1934 funds, and the Hayden-Cartwright Act, described as 1935 funds, are given in table 9. These amounts do not include $14,175,000 from 1934 funds and $20,625,000 from 1935 funds, as shown in the footnote of table 9, advanced to the States to provide revolving funds for direct payment of sums due for work done, nor do they include amounts due for work completed in a number of States for which, at the time, the Federal Government had not made reimbursement.

TABLE 9.—*Amounts paid to the States from 1934 and 1935 Public Works highway funds provided by section 204 of the National Industrial Recovery Act, and the Hayden-Cartwright Act of June 18, 1934, to June 30, 1935*

State	1934 funds	1935 funds	State	1934 funds	1935 funds
Alabama	$6,931,469.53	$835,720.72	New Hampshire	$1,808,364.34	$381,547.18
Arizona	4,831,774.08	912,237.23	New Jersey	5,321,260.24	129,813.52
Arkansas	5,557,843.03	844,391.60	New Mexico	4,546,657.67	1,321,203.11
California	13,715,032.65	638,263.03	New York	18,795,868.35	1,933,724.70
Colorado	6,483,968.20	1,935,406.48	North Carolina	7,569,167.89	947,345.32
Connecticut	2,412,116.87	357,230.33	North Dakota	4,306,854.86	235,846.43
Delaware	1,549,273.59	478,094.86	Ohio	14,555,886.80	1,075,254.00
Florida	4,774,483.91	912,777.98	Oklahoma	8,456,248.22	1,100,214.08
Georgia	7,824,108.54	810,934.67	Oregon	5,458,824.91	805,017.90
Idaho	4,126,093.70	489,359.24	Pennsylvania	15,858,935.45	2,586,088.58
Illinois	14,168,547.33	512,272.10	Rhode Island	1,775,611.06	296,332.19
Indiana	7,678,680.96	38,151.79	South Carolina	4,565,689.32	561,873.18
Iowa	9,464,102.79	1,440,225.34	South Dakota	4,502,596.75	251,468.78
Kansas	9,692,323.21	2,392,902.52	Tennessee	7,727,350.30	1,059,711.02
Kentucky	6,891,132.78	882,102.80	Texas	21,882,778.95	3,147,197.55
Louisiana	4,808,383.01	579,200.15	Utah	3,885,833.03	895,456.15
Maine	3,136,300.29	525,423.09	Vermont	1,638,755.71	297,273.37
Maryland	2,354,829.23	262,696.74	Virginia	5,674,659.43	726,456.41
Massachusetts	4,927,132.55	251,815.34	Washington	5,783,888.60	868,995.57
Michigan	11,569,048.96	1,161,863.97	West Virginia	3,631,441.91	289,320.30
Minnesota	8,749,859.02	2,008,743.42	Wisconsin	8,921,109.86	863,458.84
Mississippi	4,974,648.28	718,245.64	Wyoming	4,166,034.05	562,419.00
Missouri	10,593,796.41	1,257,797.79	District of Columbia	1,820,067.07	492,386.79
Montana	6,744,092.72	1,505,492.18	Hawaii	1,551,816.84	
Nebraska	6,554,222.94	1,343,639.60			
Nevada	4,118,805.97	867,979.25	Total [1]	338,837,772.16	44,791,371.83

[1] In addition $14,175,000 of 1934 funds and $20,625,000 of 1935 funds had been advanced to 33 States, the District of Columbia, and Hawaii to provide revolving funds from which payments were made directly.

PROGRESS OF FEDERAL-AID ROAD CONSTRUCTION

During the fiscal year a considerable mileage of road built under the Federal-aid plan was brought to completion, in spite of the diminished amount of such funds. At the close of the year Federal-aid funds for all prior years had been absorbed by assignment to projects in the current program. In doing this, advantage was taken by the States of the provision that Public Works highway grants could be used in lieu of State funds to match Federal-aid money.

Initial Federal-aid improvements were completed during the fiscal year on 1,866 miles of the Federal-aid highway system; advanced stages of improvement were constructed on 803 miles; and 12 miles previously improved were reconstructed. The total Federal-aid construction completed was therefore 2,681 miles. The result of the year's work in this single class of activity was much less than the similar mileage improved during the preceding year, which was 14,780 miles.

The improvements classed as completed and included in the above mileage figures were not only physically completed but have also been paid for by the Federal Government to the full extent of its obligation.

The distribution of the completed mileage by States, its total cost, and the Federal-aid involved are shown in table 10. For the country as a whole, the total cost was $68,651,782, of which $26,720,304 was paid from Federal-aid funds and the balance from Federal emergency and State funds. Table 11 shows the types of road comprising this improvement.

TABLE 10.—*Total cost, Federal aid, and mileage of Federal-aid roads, initial and stage construction, and reconstruction completed and paid for during the fiscal year 1935* [1]

State	Total cost	Federal aid	Mileage		
			Initial	Stage	Total
Alabama	$2,501,895.01	$1,238,792.53	38.1	79.0	117.1
Arizona	218,613.80	173,488.57	.5	8.7	9.2
Arkansas	1,316,840.86	586,614.36	91.4	35.0	126.4
California	2,029,733.83	452,616.12	25.2	3.4	28.6
Colorado	1,209,249.51	561,459.27	50.5	12.0	62.5
Connecticut	1,980,469.05	865,310.68	13.3	----------	13.3
Delaware	123,577.77	27,824.92	----------	7.2	7.2
Florida	2,396,864.34	1,075,939.48	51.1	4.0	55.1
Georgia	819,325.22	279,859.48	31.5	19.0	50.5
Idaho	553,134.07	226,731.05	10.9	47.4	58.3
Illinois	9,174,102.41	3,789,801.21	232.3	23.5	255.8
Indiana	3,746,149.04	1,581,502.34	68.5	----------	68.5
Kentucky	412,112.68	166,211.38	7.1	16.4	23.5
Louisiana	1,949,408.46	904,703.29	7.7	----------	7.7
Maryland	172,238.75	20,284.20	2.4	----------	2.4
Massachusetts	3,366,646.11	728,047.15	45.9	4.9	50.8
Michigan	2,359,732.36	871,600.87	76.6	32.1	108.7
Minnesota	1,503,853.54	504,332.38	9.3	53.3	62.6
Mississippi	4,653,854.55	2,296,409.81	137.2	93.6	230.8
Missouri	307,799.33	73,274.28	.9	2.4	3.3
Montana	1,490,369.66	832,357.27	84.3	75.4	159.7
New Hampshire	204,887.10	85,805.63	2.4	2.3	4.7
New Jersey	2,938,442.43	837,835.57	27.7	----------	27.7
New Mexico	47,997.80	23,998.90	.2	----------	.2
New York	5,566,088.20	1,868,735.38	151.9	.8	152.7
North Carolina	428,302.64	207,649.10	29.6	----------	29.6
North Dakota	142,333.37	52,383.69	22.2	37.7	59.9
Ohio	1,274,885.93	224,741.83	8.7	----------	8.7
Oklahoma	788,387.58	372,244.77	45.5	----------	45.5
Oregon	642,222.63	273,907.41	14.3	18.4	32.7
Pennsylvania	2,005,135.52	531,609.42	63.3	----------	63.3
South Carolina	1,698,519.43	616,146.04	97.5	65.9	163.4
South Dakota	501,452.16	256,386.80	71.8	25.4	97.2
Tennessee	1,180,685.45	556,567.38	24.8	[2] 19.4	44.2
Texas	1,913,020.87	775,025.61	66.3	36.3	102.6
Utah	1,140,334.99	456,202.74	43.6	56.7	100.3
Vermont	40,373.04	2,715.08	1.8	----------	1.8
Virginia	2,677,316.51	1,035,989.54	128.4	22.3	150.7
Washington	475,176.37	84,810.39	5.4	----------	5.4
West Virginia	1,406,555.76	411,312.94	41.9	----------	41.9
Wisconsin	53,529.72	4,000.00	1.3	----------	1.3
Wyoming	135,151.72	64,000.00	6.2	12.8	19.0
Hawaii	1,105,012.92	690,985.60	26.7	----------	26.7
Total	68,651,782.49	26,720,304.46	1,866.2	[2] 815.3	2,681.5

[1] No projects completed and paid for during the fiscal year in States not listed.
[2] Includes 11.6 miles of reconstruction.

A few projects which had been completed were not classified as completed as the final payment by the Federal Government had not been made. In this report these projects are classified with those under construction and approved for construction at the close of the year. Altogether, the projects in these three stages, representing the active Federal-aid improvement program at the end of the year, involved only 255 miles, as compared with a total of 2,921 miles the previous year. The large decrease is the result of the complete exhaustion of available Federal-aid funds.

Of the total of 255 miles in the current program at the end of the year, 190 miles were in course of initial improvement and 65 miles were in course of stage construction, active or planned.

TABLE 11.—*Mileage of Federal-aid roads, by types of construction, completed and final payment made during the fiscal year 1935* [1]

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland-cement concrete	Block	Bridges and approaches	Totals		
		Untreated	Treated	Untreated	Treated	Untreated	Treated							Initial	Stage	Total
Alabama	14.6						1.7	27.5		14.7	57.8		0.8	38.1	79.0	117.1
Arizona	.4							8.7					.1	.5	8.7	9.2
Arkansas	18.6			29.7	8.3			62.8			6.0		1.0	91.4	35.0	126.4
California	13.5				6.3					5.3	3.4		.1	25.2	3.4	28.6
Colorado				53.3				8.2					1.0	50.5	12.0	62.5
Connecticut	.4								0.6	.2	9.2		2.9	13.3		13.3
Delaware	7.2														7.2	7.2
Florida	35.0										18.4		1.7	51.1	4.0	55.1
Georgia	24.8										25.6		.1	31.5	19.0	50.5
Idaho				16.3				42.0						10.9	47.4	58.3
Illinois	18.1										234.2		3.5	232.3	23.5	255.8
Indiana	8.4									7.7	47.8		4.6	68.5		68.5
Kentucky	7.0										16.4		.1	7.1	16.4	23.5
Louisiana	5.3			1.1									1.3	7.7		7.7
Maryland											2.3		.1	2.4		2.4
Massachusetts									23.6	8.5	17.0		1.7	45.9	4.9	50.8
Michigan	2.6			26.0						10.5	69.1		.5	76.6	32.1	108.7
Minnesota											62.5		.1	9.3	53.3	62.6
Mississippi	112.6	9.3		4.4						19.3	81.7		3.5	137.2	93.6	230.8
Missouri				2.8									.5	.9	2.4	3.3
Montana	29.8			17.9				111.6					.4	84.3	75.4	159.7
New Hampshire							.7				4.0			2.4	2.3	4.7
New Jersey	8.0										19.3		.4	27.7		27.7
New Mexico													.2	.2		.2
New York	12.3			37.3					20.4	3.4	78.4		.9	151.9	.8	152.7
North Carolina				21.1		8.5								29.6		29.6
North Dakota	34.9			24.3				.7						22.2	37.7	59.9
Ohio										3.6	3.8	0.7	.6	8.7		8.7
Oklahoma	20.1										16.0		.4	45.5		45.5
Oregon					12.1					15.8	4.7		.1	14.3	18.4	32.7
Pennsylvania						29.1				8.8	25.1		.3	63.3		63.3
South Carolina		20.9	111.8		13.0						17.5		.2	97.5	65.9	163.4
South Dakota	39.4			32.3				25.4					.1	71.8	25.4	97.2
Tennessee	22.6									5.2	15.3		1.1	24.8	19.4	44.2
Texas	57.1			6.0	11.5						25.6		2.4	66.3	36.3	102.6
Utah				11.9				85.1			2.4		.9	43.6	56.7	100.3
Vermont				1.6									.2	1.8		1.8
Virginia	9.8	66.6		2.0		44.9	5.4			1.6	19.5		.9	128.4	22.3	150.7
Washington	5.4													5.4		5.4
West Virginia	29.2	4.5		3.0			5.1						.1	41.9		41.9
Wisconsin											1.3			1.3		1.3
Wyoming	6.2							12.8						6.2	12.8	19.0
Hawaii									26.5				.2	26.7		26.7
Total	552.3	101.3	111.8	291.0	51.2	82.5	12.9	384.8	71.1	104.6	884.3	.7	33.0	1,866.2	815.3	2,681.5

[1] No mileage completed and final payment made during the fiscal year in States not listed.

The distribution, by States, of the Federal-aid mileage in the three stages of progress toward completion is shown in table 12, together with estimated total costs and the amounts of Federal aid allotted. As in the case of the completed projects the difference between the total cost and the Federal aid has been supplied from Federal emergency-construction funds and State funds. For the country as a whole, the estimated cost of the projects in progress toward completion at the end of the year was $7,126,347; the Federal aid allotted was $2,902,276.

The classification of the projects in the active program by types of surface improvement is shown in table 13.

TABLE 12.—*Total cost, Federal aid, and mileage of Federal-aid roads, initial and stage improvement, finally inspected, under construction, and approved for construction, June 30, 1935* [1]

State	Estimated total cost	Federal aid allotted [2]	Mileage		
			Initial	Stage	Total
Florida	$60,870.23	$30,435.11	6.6		6.6
Idaho	285,791.82	100,207.19	11.2	2.5	13.7
Illinois	844,052.38	295,835.53	12.0	20.6	32.6
Indiana	1,075,119.20	468,901.51	36.5		36.5
Louisiana	526,881.94	256,601.57		.4	.4
Michigan	84,600.00	37,000.48	.5	.3	.8
Minnesota	888,670.49	333,114.93	34.6		34.6
Mississippi	174,457.73	87,228.86		8.2	8.2
New York	1,083,919.43	304,629.71	35.7		35.7
North Dakota	350,769.16	350,553.58	1.9		1.9
Ohio	90,780.00	45,390.00	5.3		5.3
Oklahoma	833,060.90	339,104.72	18.3	21.0	39.3
Pennsylvania	528,840.88	162,417.62	19.0		19.0
Texas	298,532.44	90,855.62	8.3	11.7	20.0
Total	7,126,346.60	2,902,276.43	189.9	64.7	254.6

[1] No projects in this status in States not listed and Hawaii.
[2] Does not include Federal aid allotted to Public Works projects.

TABLE 13.—*Mileage of Federal-aid roads, by types of construction, initial and stage, finally inspected under construction and approved for construction, June 30, 1935* [1]

State	Graded and drained	Untreated gravel	Untreated macadam	Low cost bituminous mix	Bituminous concrete	Portland-cement concrete	Bridges and approaches	Total		
								Initial	Stage	Total
Florida	6.6							6.6		6.6
Idaho		11.1		2.5			0.1	11.2	2.5	13.7
Illinois						32.5	.1	12.0	20.6	32.6
Indiana						36.5		36.5		36.5
Louisiana						.2	.2		.4	.4
Michigan						.5	.3	.5	.3	.8
Minnesota						34.6		34.6		34.6
Mississippi	.2					8.0			8.2	8.2
New York	5.8	20.7				9.0	.2	35.7		35.7
North Dakota		1.6					.3	1.9		1.9
Ohio					5.3			5.3		5.3
Oklahoma	13.0					26.2	.1	18.3	21.0	39.3
Pennsylvania			7.9		5.1	6.0		19.0		19.0
Texas	8.2					11.8		8.3	11.7	20.0
Total	33.8	33.4	7.9	2.5	10.4	165.3	1.3	189.9	64.7	254.6

[1] No projects in this status in States not listed and Hawaii.

PROGRESS IN PUBLIC WORKS HIGHWAY CONSTRUCTION

The Public Works highway program, initiated in June 1933 with $400,000,000 provided by the National Recovery Act and supplemented in June 1934 with $200,000,000 authorized by the Hayden-Cartwright Act has resulted in a completed mileage sufficient to encircle the earth, and at the close of the year the mileage included in the current program, either under construction or planned, exceeded the diameter of the earth.

From the beginning of construction in August 1933 up to the end of the fiscal year 1935, construction has been begun on 33,129 miles of road and completed on 24,600 miles, leaving 8,529 miles under construction on June 30, 1935. On the same date projects approved for construction included 1,427 miles, so that there was included in the 2 years' program a total of 34,556 miles.

The total cost of projects completed under the program has been $397,355,775, of which $335,830,226 was from 1934 Public Works highway funds, and $30,071,390 was from 1935 similar funds. The estimated total cost of the projects under construction at the end of the year was $185,049,282, of which $50,310,307 was 1934 funds, and $118,520,398 was 1935 funds. The projects approved for construction at the same time amounted to $27,826,927, of which $2,840,824 was from 1934 funds and $23,166,829 from 1935 funds. The total for the 2-year active program, not including projects approved for construction, was $582,405,057. The above total amounts include small amounts of Federal-aid funds and State funds.

Of the 24,600 miles of completed projects, 13,338 miles were located on the Federal-aid highway system outside of municipalities. This improvement cost $201,669,124, of which $178,805,890 was paid from Public Works funds, and the remainder from Federal-aid funds and from Federal emergency-construction and State funds.

On extensions of the Federal-aid system into and through municipalities there were completed 1,904 miles, costing $103,763,295. Of the total cost of this mileage, the Public Works funds provided $99,605,210, and the balance was provided from the above-mentioned sources.

The remaining completed mileage—9,358 miles, costing $91,923,356—consisted of secondary or feeder roads. The cost of these was met to the extent of $87,490,517 from Public Works funds and the balance was paid from State funds. Federal-aid and emergency-construction funds were not available for this portion of the work because the roads improved are in no case included in the Federal-aid system.

The distribution, by States, of the mileage completed to June 30, 1935, in each of the three classes of projects is given in tables 14 and 15, together with total costs of the roads built and the amounts of the funds used in each of the fiscal years 1934 and 1935.

Of the 8,530 miles under construction at the end of the year, 4,003 miles were on the Federal-aid system outside of municipalities, 509 miles on extensions of the system into and through cities, and 4,018 miles on secondary or feeder roads. The estimated costs of each of these groups of projects, the sources of the funds employed, and the distribution by States are shown in tables 16 and 17.

TABLE 14.—*Total cost and mileage of 1934 Public Works highway projects financed with funds provided by section 204 of the National Industrial Recovery Act, completed to June 30, 1935, and Federal funds allotted thereto, by States*

PROJECTS ON THE FEDERAL-AID SYSTEM OUTSIDE OF MUNICIPALITIES[1]

State	Total cost	Federal funds allotted		Mileage
		Public Works funds	Federal-aid funds	
Alabama	$6,205,589.83	$3,370,573.59	$2,827,592.07	326.0
Arizona	4,501,873.17	3,832,516.57	78,138.13	297.3
Arkansas	3,044,050.54	2,517,988.43	499,568.46	152.8
California	10,463,432.19	7,752,827.83	8,238.65	311.6
Colorado	3,458,657.71	3,347,940.85	87,057.48	156.7
Connecticut	794,425.68	791,923.12		14.5
Delaware	875,222.73	868,470.17		33.4
Florida	3,025,254.26	2,214,247.01	756,396.29	115.7
Georgia	4,158,574.97	3,921,287.59	65,840.00	285.3
Idaho	2,097,380.44	2,027,113.60		173.1
Illinois	2,438,123.40	2,392,590.47		39.3
Indiana	3,574,648.62	3,451,916.23		112.9
Iowa	4,806,144.05	4,720,930.00		259.1
Kansas	5,135,668.69	5,004,394.25	113,490.85	402.7
Kentucky	3,623,147.32	3,379,305.06		244.5
Louisiana	2,664,382.38	2,295,364.99		76.2
Maine	1,463,772.98	1,433,663.50		44.0
Maryland	792,730.48	791,495.03		14.8
Massachusetts	1,466,324.25	1,049,029.03	385,643.88	37.4

[1] No projects of this class completed in the District of Columbia.

TABLE 14.—*Total cost and mileage of 1934 Public Works highway projects financed with funds provided by section 204 of the National Industrial Recovery Act, completed to June 30, 1935, and Federal funds allotted thereto, by States*—Con.

PROJECTS ON THE FEDERAL-AID SYSTEM OUTSIDE OF MUNICIPALITIES—Contd.

State	Total cost	Federal funds allotted		Mileage
		Public Works funds	Federal-aid funds	
Michigan	$5,175,046.24	$4,921,541.23	$49,000.00	231.6
Minnesota	4,333,008.47	4,235,784.24	57,982.87	747.7
Mississippi	4,649,133.81	2,521,708.69	2,087,522.91	245.5
Missouri	4,883,071.14	4,295,899.47	100,748.60	198.1
Montana	4,872,999.11	4,403,620.91	373,577.49	377.7
Nebraska	5,004,657.89	3,888,841.49	248,543.24	356.5
Nevada	2,754,513.50	2,683,175.23	43,327.07	260.3
New Hampshire	638,683.78	612,389.01		10.8
New Jersey	2,189,130.63	2,025,845.49	139,466.42	37.4
New Mexico	2,892,412.26	2,748,086.29	143,929.42	274.2
New York	11,245,771.06	9,011,287.80	461,500.00	219.5
North Carolina	4,274,856.34	3,580,995.46	680,062.84	557.8
North Dakota	3,005,644.11	2,611,832.03	370,075.02	961.5
Ohio	7,431,049.76	7,040,235.46	51,410.00	191.3
Oklahoma	4,337,923.71	4,201,026.95	6,235.56	297.9
Oregon	3,284,391.98	2,942,972.75	217,337.94	182.8
Pennsylvania	6,463,235.70	6,190,604.69	3,826.93	127.4
Rhode Island	968,004.74	899,627.39	62,867.28	20.5
South Carolina	2,424,177.24	2,359,621.33	62,876.51	208.2
South Dakota	2,920,377.33	2,451,549.34	458,415.98	485.6
Tennessee	4,645,729.84	4,004,620.87	593,951.35	180.9
Texas	11,770,771.03	11,174,335.63		1,005.8
Utah	2,467,363.33	2,324,852.07	48,000.00	195.2
Vermont	951,975.39	911,183.87		44.8
Virginia	3,566,117.71	3,322,846.03	235,430.47	146.1
Washington	2,855,483.04	2,794,488.77	3,356.82	102.7
West Virginia	1,943,070.51	1,901,842.01	12,956.18	72.1
Wisconsin	4,434,758.01	4,220,288.15	39,690.60	209.0
Wyoming	2,227,399.17	2,064,028.48	140,708.57	457.3
Hawaii	829,029.22	526,724.18	232,492.95	19.3
Total	184,029,189.74	162,035,432.63	11,747,258.23	11,522.8

PROJECTS ON EXTENSIONS OF THE FEDERAL-AID SYSTEM INTO AND THROUGH MUNICIPALITIES [2]

Alabama	$1,777,249.49	$1,768,479.78		43.9
Arizona	632,961.16	623,659.51		13.2
Arkansas	1,699,989.32	1,599,133.99	$95,457.30	42.5
California	4,459,926.89	3,849,724.09		52.5
Colorado	1,768,937.14	1,675,081.08		35.3
Connecticut	828,471.21	802,407.00	23,450.79	10.2
Delaware	468,789.18	460,282.30		6.7
Florida	1,723,761.56	1,437,885.39	282,545.85	18.7
Georgia	2,232,507.32	2,200,119.62		68.3
Idaho	1,149,665.60	1,107,063.23		18.3
Illinois	6,418,737.15	6,122,745.55		66.4
Indiana	3,174,027.17	3,034,021.12		63.5
Iowa	2,098,436.48	2,013,667.98		51.1
Kansas	2,554,892.04	2,401,598.40		37.1
Kentucky	1,468,314.08	1,416,933.57		32.4
Louisiana	748,870.30	744,920.59		18.5
Maine	830,660.76	825,162.11	172.41	16.4
Maryland	390,020.65	384,016.57		3.6
Massachusetts	2,143,777.41	2,102,232.49	37,100.00	13.4
Michigan	3,239,170.40	3,104,881.06		39.0
Minnesota	3,189,479.97	3,140,755.80	2,500.00	98.3
Mississippi	911,532.05	897,960.23	12,459.50	28.7
Missouri	2,920,631.89	2,844,980.94		51.7
Montana	1,025,022.12	1,012,209.09	939.47	34.0
Nebraska	1,951,800.54	1,917,390.47		33.0
Nevada	479,799.69	473,901.01		9.4
New Hampshire	672,133.04	668,775.82	1,484.17	15.6
New Jersey	2,952,932.93	2,828,272.05	103,846.83	22.5
New Mexico	1,471,683.93	1,471,119.76		33.8
New York	7,588,170.47	7,168,742.06	39,000.00	58.0
North Carolina	2,128,779.90	2,125,249.40	1,701.23	75.0
North Dakota	1,078,034.52	1,070,768.53	586.33	45.8
Ohio	4,710,282.60	4,238,313.72		59.5
Oklahoma	2,178,496.66	2,098,728.20	779.60	44.7
Oregon	1,470,358.96	1,424,030.60	13,625.38	27.7
Pennsylvania	4,362,458.61	4,197,457.50		58.6

[2] No projects of this class completed in Hawaii.

TABLE 14.—*Total cost and mileage of 1934 Public Works highway projects financed with funds provided by section 204 of the National Industrial Recovery Act, completed to June 30, 1935, and Federal funds allotted thereto, by States*—Con.

PROJECTS ON EXTENSIONS OF THE FEDERAL-AID SYSTEM INTO AND THROUGH MUNICIPALITIES—Continued

State	Total cost	Federal funds allotted		Mileage
		Public Works funds	Federal-aid funds	
Rhode Island	$519,889.48	$518,990.77		7.4
South Carolina	1,095,075.84	1,092,876.53	$405.01	34.5
South Dakota	1,070,769.37	1,070,366.12		35.7
Tennessee	1,759,229.54	1,740,185.92		24.8
Texas	5,216,863.22	5,093,601.29		117.5
Utah	699,529.23	649,145.73		16.7
Vermont	529,077.38	460,327.69	6,553.48	13.7
Virginia	1,282,757.36	1,250,265.23	10,812.54	25.1
Washington	1,942,398.47	1,922,046.25		32.1
West Virginia	1,042,645.05	1,005,009.18		16.8
Wisconsin	2,477,252.65	2,401,817.98	25,898.24	51.6
Wyoming	974,383.29	971,191.34		22.3
District of Columbia	696,280.55	696,280.55		4.5
Total	98,216,914.62	94,124,775.19	659,318.13	1,750.0

PROJECTS ON SECONDARY OR FEEDER ROADS

Alabama	$1,486,623.66	$1,482,576.10		109.2
Arizona	549,547.58	531,272.95		43.8
Arkansas	1,249,714.14	1,243,181.47		149.1
California	3,592,883.65	2,984,134.18		164.3
Colorado	1,696,998.30	1,605,434.83		138.3
Connecticut	179,776.83	160,281.50		3.1
Delaware	269,715.25	265,665.61		14.1
Florida	1,297,524.39	1,284,727.07		74.8
Georgia	1,623,724.69	1,604,794.36		123.1
Idaho	1,263,231.37	1,094,529.68		144.3
Illinois	3,073,727.65	3,035,675.87		160.0
Indiana	425,393.70	386,212.34		44.1
Iowa	2,295,545.56	2,241,349.10		297.8
Kansas	2,088,099.23	2,085,241.57		150.4
Kentucky	1,874,533.90	1,750,680.26		207.1
Louisiana	1,045,811.69	1,035,963.10		48.0
Maine	926,000.11	842,403.50		69.9
Maryland	829,678.97	781,556.28		57.6
Massachusetts	477,469.65	469,741.41		15.2
Michigan	3,105,699.56	2,906,940.22		205.4
Minnesota	2,204,027.13	2,194,840.21		193.5
Mississippi	1,165,847.02	1,165,847.02		123.7
Missouri	2,761,470.20	2,686,006.24		497.7
Montana	1,760,235.26	1,751,640.86		225.9
Nebraska	1,972,044.00	1,957,240.00		263.6
Nevada	1,139,425.65	1,113,353.49		109.6
New Hampshire	491,947.70	448,385.73		24.2
New Jersey	56,527.92	55,098.73		.5
New Mexico	1,235,197.98	1,235,197.98		205.0
New York	3,326,621.17	3,035,560.14		83.9
North Carolina	2,191,064.04	2,187,037.40		228.8
North Dakota	1,014,150.22	1,013,517.73		309.0
Ohio	4,012,658.13	3,754,142.44		296.3
Oklahoma	2,159,942.55	2,032,584.07		260.0
Oregon	1,641,441.88	1,501,340.67		108.1
Pennsylvania	6,428,967.73	6,260,218.79		541.3
Rhode Island	449,748.30	439,716.00		33.1
South Carolina	1,087,287.82	1,086,654.80		115.5
South Dakota	1,270,093.71	1,270,006.65		380.1
Tennessee	1,679,297.63	1,612,242.88		126.9
Texas	6,409,709.55	5,954,261.56		773.5
Utah	1,109,863.65	954,654.55		149.2
Vermont	505,615.68	438,631.41		36.4
Virginia	1,634,274.65	1,567,018.81		202.5
Washington	1,108,378.74	1,080,673.00		67.6
West Virginia	770,892.33	726,068.35		42.0
Wisconsin	2,298,476.16	2,158,518.02		167.6
Wyoming	1,064,861.09	1,047,457.51		145.4
District of Columbia	972,024.45	972,024.45		7.7
Hawaii	178,208.97	177,717.69		4.9
Total	83,452,001.19	79,670,018.58		7,948.1

TABLE 15.—*Total cost and mileage of 1935 Public Works highway projects financed with funds provided by the Hayden-Cartwright Act of June 18, 1934, completed to June 30, 1935, and Federal funds allotted thereto by States*

PROJECTS ON THE FEDERAL-AID SYSTEM OUTSIDE OF MUNICIPALITIES[1]

State	Total cost	Federal funds allotted		Mileage
		Public Works funds	Federal-aid funds	
Alabama	$35,889.47	$35,889.47		14.2
Arizona	471,297.49	458,904.66		56.3
Arkansas	363,850.82	335,091.20	$28,632.77	12.3
California	516,028.33	476,000.00		52.5
Colorado	1,651,494.55	1,628,991.40		86.2
Delaware	330,607.95	317,536.98		12.2
Florida	264,419.89	264,419.89		9.9
Georgia	424,650.91	424,650.91		33.7
Idaho	155,805.70	154,028.23		25.4
Illinois	143,131.96	142,889.96		1.0
Indiana	35,317.13	35,317.13		
Iowa	333,105.29	314,620.00		58.2
Kansas	780,967.83	780,018.60		234.7
Kentucky	198,470.48	196,985.36		36.0
Louisiana	40,686.82	40,686.82		.6
Maine	93,719.61	93,719.61		3.4
Maryland	74,648.81	74,648.81		.7
Michigan	81,400.00	81,400.00		2.6
Minnesota	1,448,083.98	1,365,524.47		162.4
Mississippi	490,683.24	490,683.24		23.7
Montana	1,566,794.43	1,566,280.97		186.7
Nebraska	148,532.78	137,283.57		12.9
Nevada	605,805.48	604,881.16		62.2
New Hampshire	89,621.01	89,272.86		1.8
New Jersey	42,612.52	15,000.00		
New Mexico	812,459.42	812,459.42		89.7
New York	296,087.80	230,230.00		4.5
North Carolina	679,374.10	392,190.26	287,183.84	44.9
North Dakota	245,708.08	218,195.17	27,254.54	160.9
Ohio	88,100.00	88,100.00		3.9
Oklahoma	384,142.78	384,142.78		20.2
Oregon	330,811.09	279,947.09	50,000.00	11.1
Pennsylvania	594,435.02	593,079.55		12.5
South Carolina	111,964.67	111,964.67		8.8
South Dakota	160,756.21	160,756.21		70.5
Tennessee	333,219.48	333,219.48		11.3
Texas	983,794.20	983,266.67		111.9
Utah	677,675.01	553,524.55	85,000.00	78.7
Vermont	35,225.08	34,775.08		3.2
Virginia	514,995.80	469,944.82	44,821.84	19.0
Washington	200,639.96	200,520.77		3.7
West Virginia	195,860.50	195,860.50		7.2
Wisconsin	154,752.05	151,270.63		5.8
Wyoming	452,293.16	452,284.00		58.5
Total	17,639,933.89	16,770,456.95	522,892.99	1,814.9

PROJECTS ON EXTENSIONS OF THE FEDERAL-AID SYSTEM INTO AND THROUGH MUNICIPALITIES[2]

Alabama	$98,283.79	$98,283.79		2.2
Arizona	47,141.90	37,302.77		1.0
Arkansas	70,342.15	70,342.15		1.9
California	275,475.69	258,050.00		7.7
Colorado	169,410.60	169,410.60		4.6
Connecticut	10,077.96	9,362.04		
Delaware	51,542.45	51,542.45		.6
Florida	102,826.90	102,826.90		2.7
Georgia	35,648.19	35,648.19		1.7
Idaho	11,841.45	11,571.90		1.8
Indiana	14,011.76	14,011.76		.3
Iowa	75,627.57	71,035.00		6.3
Kansas	180,411.35	176,992.33		5.2
Kentucky	27,428.21	27,428.21		1.8
Louisiana	61,390.74	61,390.74		1.7
Michigan	104,400.00	104,400.00		.6
Minnesota	290,146.65	288,822.11		12.5
Mississippi	95,558.48	95,558.48		3.3

[1] No projects of this class completed in States not listed, the District of Columbia, and Hawaii.
[2] No projects of this class completed in States not listed and Hawaii.

TABLE 15.—*Total cost and mileage of 1935 Public Works highway projects financed with funds provided by the Hayden-Cartwright Act of June 18, 1934, completed to June 30, 1935, and Federal funds allotted thereto by States*—Continued

PROJECTS ON EXTENSIONS OF THE FEDERAL-AID SYSTEM INTO AND THROUGH MUNICIPALITIES—Continued

State	Total cost	Federal funds allotted		Mileage
		Public Works funds	Federal-aid funds	
Missouri	$18,790.55	$18,790.55		0.2
Montana	32,919.00	32,919.00		
Nebraska	320,655.36	320,655.36		7.9
Nevada	49,331.47	49,331.47		.8
New Hampshire	102,288.40	102,288.40		1.3
New Jersey	3,316.01	3,316.01		.4
New Mexico	180,097.17	180,097.17		5.2
New York	338,700.00	338,700.00		2.4
North Carolina	541,177.44	536,087.26	$5,090.18	16.7
North Dakota	1,163.70	1,163.70		.8
Ohio	163,767.25	163,065.24		5.6
Oklahoma	199,101.74	199,101.74		3.6
Oregon	103,906.99	103,906.99		3.5
Pennsylvania	506,119.54	505,373.22		10.8
South Dakota	1,360.87	1,360.87		1.1
Tennessee	116,430.62	116,430.62		1.1
Texas	167,664.48	167,664.48		11.3
Utah	76,132.28	63,066.11		3.5
Vermont	37,526.82	36,000.00		.7
Virginia	220,169.76	215,043.32	5,126.44	5.4
Washington	308,461.88	305,761.08		3.3
West Virginia	28,109.01	28,109.01		.9
Wisconsin	123,788.47	123,788.47		3.9
Wyoming	2,784.76	2,784.00		.2
District of Columbia	181,051.07	181,051.07		2.0
Total	5,546,380.48	5,480,434.56	10,216.62	153.5

PROJECTS ON SECONDARY OR FEEDER ROADS[1]

Alabama	$92,973.82	$92,973.82		7.0
Arizona	217,196.18	186,412.63		21.5
California	38,646.85	37,900.00		6.1
Colorado	555,225.58	277,323.58		93.7
Connecticut	12,888.94	12,888.94		.4
Delaware	158,976.51	155,213.26		37.4
Florida	322,933.99	322,933.99		13.7
Idaho	144,223.51	135,239.87		19.8
Iowa	328,193.43	315,850.00		115.6
Kansas	141,391.73	141,391.73		77.4
Kentucky	279,409.82	275,369.30		31.1
Louisiana	101,176.02	101,176.02		2.5
Maine	320,207.73	319,278.85		28.5
Maryland	41,222.90	41,222.90		1.9
Michigan	39,700.00	39,700.00		.3
Minnesota	558,120.92	484,888.55		100.9
Mississippi	10,000.00	10,000.00		6.5
Missouri	240,144.63	239,272.45		151.1
Montana	405,178.29	405,178.29		38.3
Nebraska	456,960.33	456,960.33		157.3
Nevada	353,854.51	352,874.33		75.8
New Hampshire	45,227.90	43,003.83		1.5
New Mexico	262,434.99	262,434.99		36.2
New York	354,223.99	209,288.61		9.1
North Carolina	458,052.48	458,052.48		61.1
North Dakota	46,073.64	46,073.64		13.4
Ohio	101,950.00	101,950.00		15.5
Oklahoma	50,770.15	50,770.15		11.3
Oregon	457,474.13	419,957.23		44.4
Pennsylvania	226,160.04	225,686.53		13.4
South Carolina	99,102.42	99,102.42		8.9
South Dakota	78,372.54	78,372.54		17.3
Tennessee	124,457.87	124,457.87		5.7
Texas	448,005.99	448,005.99		77.3
Utah	243,836.42	192,800.00		46.2
Vermont	57,539.15	57,503.82		3.1
Virginia	22,310.23	22,310.23		9.3
Washington	226,285.16	226,228.74		33.1
Wisconsin	48,583.45	48,583.45		2.8
Wyoming	135,377.42	135,376.00		11.4
District of Columbia	166,491.42	166,491.42		2.5[2]
Total	8,471,355.08	7,820,498.78		1,410.3

[1] No projects of this class completed in States not listed and Hawaii.

TABLE 16.—*Total cost and mileage of 1934 Public Works highway projects financed with funds provided by section 204 of the National Industrial Recovery Act, under construction June 30, 1935, and Federal funds allotted thereto, by States*

PROJECTS ON THE FEDERAL-AID SYSTEM OUTSIDE OF MUNICIPALITIES [1]

State	Estimated total cost	Federal funds allotted		Mileage
		Public Works funds	Federal-aid funds	
Alabama	$929,126.70	$530,261.54	$398,865.16	52.4
Arkansas	760,736.85	643,216.22	117,520.63	20.8
California	920,981.81	158,740.56		5.2
Colorado	132,907.59	82,696.81	36,500.00	4.2
Connecticut	802,607.64	611,294.44	191,213.20	16.3
Delaware	4,973.04	4,973.04		
Florida	258,441.11	220,894.89	37,546.22	2.3
Georgia	1,061,740.78	978,717.13	83,023.65	34.4
Idaho	143,741.95	131,758.66	11,983.29	4.7
Illinois	2,002,681.43	2,002,681.43		16.6
Indiana	1,428,619.62	1,427,908.10		28.2
Iowa	325,120.40	306,900.00		10.0
Kansas	31,529.65	31,529.65		5.0
Kentucky	392,181.39	316,513.72	13,361.92	13.1
Louisiana	515,017.51	368,904.43		2.8
Maine	117,934.18	117,934.18		.6
Maryland	797,232.25	797,232.25		16.5
Massachusetts	52,686.97	52,686.97		.3
Michigan	1,075,800.00	1,075,800.00		40.8
Minnesota	192,247.59	192,247.59		19.7
Mississippi	1,549,626.51	893,810.26	655,816.25	85.9
Missouri	990,850.70	861,589.21	73,162.40	14.3
Montana	64,686.16	4,129.31	32,001.66	19.3
Nebraska	252,801.31	25,639.51		6.1
Nevada	187,644.11	187,644.11		25.5
New Hampshire	96,866.55	79,729.64	17,136.91	.3
New Jersey	1,135,261.50	1,113,073.72	12,676.78	10.8
New Mexico	114,088.04	98,561.71		5.0
New York	1,490,230.00	1,262,471.81		28.2
North Carolina	907,820.89	775,949.23	131,871.66	81.4
North Dakota	161,368.12	98,160 47	63,207.65	40.9
Ohio	192,470.00	186,080.92	4,989.08	4.5
Oklahoma	515,959.55	396,183.38	119,776.17	21.4
Oregon	161,687.91	80,589.91		.5
Pennsylvania	630,718.27	442,031.34	30,620.92	5.6
Rhode Island	88,603.07	79,739.61		1.3
South Carolina	315,630.36	315,630.36		28.4
South Dakota	519,142.31	486,318.32	32,823 99	78.1
Tennessee	272,948.05	176,546 93	14,299.75	5.0
Texas	424,980.99	387,980 99		29.2
Utah	37,409.68	37,000.00		.8
Vermont	27,413.87	10,670.21		.4
Virginia	249,657.81	233,865.48	11,757.70	15.0
Washington	227,921.65	227,921.65		7.6
West Virginia	57,156.19	57,156.19		.2
Wisconsin	445,826.77	445,826.77		21.1
Wyoming	208,543.19	182,391.43	25,600.00	3.5
Hawaii	1,331,572.45	1,126,854.57	183,588.47	20.3
Total	24,595,194.47	20,326,438.65	2,299,443.46	854.5

[1] No projects of this class under construction in Arizona and the District of Columbia.

PROJECTS ON EXTENSIONS OF THE FEDERAL-AID SYSTEM INTO AND THROUGH MUNICIPALITIES [2]

Alabama	$568,563.40	$568,563 40		20.4
Arkansas	249,166.70	248,966.70		2.5
California	517,127.05	356,839.76		.1
Florida	2,898.50	2,898.50		
Georgia	315,541.40	308,553.95	$6,987.45	7.7
Idaho	45,371 70	45,371.70		.1
Illinois	1,202,053.81	1,202,053.81		4.1
Indiana	1,075,628.48	1,073,164.60		9.2
Iowa	645,327.36	600,765.25		6.2
Kansas	71,884.18	71,884.18		.6
Kentucky	458,136.59	450,553.92		2.1
Louisiana	988,110.21	946,156.66	41,953.55	10.7
Maine	67,228.11	67,228.11		1.0
Maryland	1,075,977.75	262,456.99		.9
Massachusetts	2,901,347.79	2,876,371.63	24,976.16	3.4

[2] No projects of this class under construction in States not listed and Hawaii.

TABLE 16.—*Total cost and mileage of 1934 Public Works highway projects financed with funds provided by section 204 of the National Industrial Recovery Act, under construction June 30, 1935, and Federal funds allotted thereto, by States*—Con.

PROJECTS ON EXTENSIONS OF THE FEDERAL-AID SYSTEM INTO AND THROUGH MUNICIPALITIES—Continued

State	Estimated total cost	Federal funds allotted		Mileage
		Public Works funds	Federal-aid funds	
Michigan	$369,750.00	$357,250.00		2.4
Minnesota	607,095.94	520,812.92		1.3
Mississippi	829,119.69	764,058.20	$46,061.49	19.9
Missouri	1,067,899.45	1,022,062.03		6.8
Montana	93,359.73	66,067.94	27,291.79	4.5
New Hampshire	71,558.80	71,558.80		1.8
New Jersey	182,690.19	182,690.19		.3
New Mexico	123,326.38	123,326.38		1.2
New York	1,050,661.42	887,217.02		4.2
North Carolina	155,690.18	125,112.60	30,577.58	4.8
North Dakota	238,526.73	238,526.73		7.5
Oklahoma	171,034.81	167,849.07		2.1
Oregon	74,643.86	66,634.90		1.0
Pennsylvania	681,120.30	592,456.56		2.4
South Carolina	258,167.47	252,616.63	5,550.84	10.8
South Dakota	183,141.89	183,141.89		7.1
Tennessee	371,898.49	371,898.49		2.7
Texas	1,401,142.64	1,244,952.30		7.8
Utah	129,468.43	129,130.39		.4
Vermont	26,801.55	26,801.55		.9
Virginia	883,957.26	634,441.09	8,276.21	3.6
Washington	48,798.52	48,798.52		1.0
West Virginia	307,661.19	307,661.19		3.5
Wisconsin	113,025.39	113,025.39		.1
Wyoming	141,589.33	141,009.60		1.8
District of Columbia	250,164.00	250,164.00		.2
Total	20,026,656.67	17,971,392.94	191,675.07	169.1

PROJECTS ON SECONDARY OR FEEDER ROADS[1]

Alabama	$507,248.23	$507,248.23		32.2
Arkansas	152,928.42	152,568.42		12.2
California	563,450.52	494,605.31		16.7
Colorado	185,664.57	110,000.00		10.1
Connecticut	504,634.08	498,838.50		11.5
Delaware	215,682.00	215,447.79		2.5
Georgia	620,787.73	620,787.73		41.3
Illinois	2,727,238.31	2,727,238.31		166.6
Indiana	310,432.90	310,432.90		43.4
Iowa	182,999.54	171,301.73		24.1
Kansas	393,660.62	393,660.62		12.6
Kentucky	67,732.52	67,732.52		12.0
Louisiana	260,029.86	260,029.86		11.3
Maryland	99,745.80	99,745.80		8.8
Michigan	241,227.00	241,227.00		19.0
Minnesota	149,443.85	149,443.85		4.5
Mississippi	543,534.41	543,534.41		39.4
Missouri	280,804.39	235,551.21		16.3
New Hampshire	29,000.00	29,000.00		1.3
New Mexico	36,931.02	36,931.02		8.2
New York	640,500.00	515,500.00		15.7
North Carolina	160,265.46	160,265.46		8.2
North Dakota	303,198.16	303,198.16		100.6
Ohio	32,860.00	32,860.00		5.6
Oklahoma	282,377.22	265,837.68		19.1
Oregon	19,525.71	19,525.71		.2
Pennsylvania	1,119,999.94	1,066,649.12		96.9
South Carolina	227,517.61	227,517.61		33.7
South Dakota	232,863.35	232,863.35		69.9
Tennessee	429,039.85	429,039.85		23.9
Texas	16,516.74	16,516.74		.8
Utah	108,127.25	94,022.45		12.1
Virginia	104,247.26	104,247.26		3.4
West Virginia	387,152.35	387,152.35		15.1
Wisconsin	331,847.48	258,460.28		16.5
Wyoming	33,501.60	33,494.00		8.5
Total	12,502,715.75	12,012,475.23		924.2

[1] No projects of this class under construction in States not listed, the District of Columbia, and Hawaii.

TABLE 17.—*Total cost and mileage of 1935 Public Works highway projects financed with funds provided by the Hayden-Cartwright Act of June 18, 1934, under construction on June 30, 1935, and Federal funds allotted thereto, by States*

PROJECTS ON THE FEDERAL-AID SYSTEM OUTSIDE OF MUNICIPALITIES [1]

State	Estimated total cost	Federal funds allotted		Mileage
		Public Works funds	Federal-aid funds	
Alabama	$1,235,513.03	$1,235,513.03		71.6
Arizona	982,993.70	870,052.18		42.4
Arkansas	1,142,590.59	973,714.66	$168,255.93	69.2
California	2,266,719.22	2,119,795.23		55.9
Colorado	825,069.05	786,221.95		40.3
Connecticut	670,945.98	554,725.61	116,220.37	7.1
Delaware	133,550.00	133,550.00		3.2
Florida	606,335.03	606,335.03		27.9
Georgia	1,149,032.86	1,149,032.86		70.7
Idaho	459,597.31	445,173.06	13,544.24	28.6
Illinois	1,987,890.38	1,987,890.38		50.5
Indiana	2,443,414.04	2,279,625.42	18,274.51	135.1
Iowa	2,004,889.57	1,715,528.60		108.1
Kansas	1,614,717.21	1,546,923.37		120.2
Kentucky	801,217.07	792,538.75	4,534.97	43.6
Louisiana	1,105,850.67	1,098,700.05		26.1
Maine	494,534.43	494,534.43		9.5
Maryland	178,571.16	178,571.16		4.8
Massachusetts	1,041,709.99	989,888.41	51,821.58	19.9
Michigan	2,371,800.00	2,350,736.48	21,063.52	95.0
Minnesota	737,717.12	737,117.12		100.2
Mississippi	1,321,253.57	1,323,253.57		74.2
Missouri	1,936,319.39	1,877,065.61		70.5
Montana	1,017,215.99	975,696.17	41,519.82	52.3
Nebraska	1,872,142.32	1,748,711.97		98.9
Nevada	499,452.95	498,785.75		74.2
New Hampshire	356,384.03	352,131.53		10.4
New Jersey	650,905.68	575,606.68		4.4
New Mexico	562,945.51	562,945.51		40.0
New York	6,055,080.00	3,246,551.69	58,928.31	109.2
North Carolina	598,824.90	545,824.90	53,000.00	75.3
North Dakota	521,041.33	409,315.43	111,725.90	162.7
Ohio	3,182,256.00	2,854,513.00	137,130.00	64.6
Oklahoma	1,521,275.03	1,428,536.88	30,238.15	58.5
Oregon	1,142,678.66	1,103,851.77	9,660.36	54.9
Pennsylvania	3,800,016.42	3,757,563.61		75.5
Rhode Island	471,988.57	464,572.00		13.0
South Carolina	351,415.73	351,415.73		27.3
South Dakota	987,435.21	966,352.61	21,082.60	157.3
Tennessee	1,313,145.64	1,313,145.64		50.7
Texas	4,727,034.13	4,564,419.90	162,614.23	343.8
Utah	468,962.67	360,550.00	53,499.15	28.3
Vermont	364,218.26	353,388.49		17.3
Virginia	1,264,677.22	1,101,175.87	160,966.74	62.2
Washington	1,332,783.10	1,212,203.56		16.0
West Virginia	456,667.87	456,667.87		17.0
Wisconsin	1,611,152.33	1,531,644.27		66.4
Wyoming	1,030,753.30	1,030,740.00		193.3
Total	63,672,684.22	58,012,797.79	1,233,480.38	3,148.1

PROJECTS ON EXTENSIONS OF THE FEDERAL-AID SYSTEM INTO AND THROUGH MUNICIPALITIES [2]

Alabama	$282,641.23	$282,641.23		5.7
Arizona	107,876.87	95,500.39		.6
Arkansas	328,005.98	326,803.48		8.1
California	2,883,600.74	1,749,825.95		13.3
Connecticut	193,691.99	142,520.92	$51,171.07	1.6
Delaware	40,287.55	40,287.55		1.8
Florida	154,249.88	154,249.88		1.4
Georgia	415,349.19	405,048.89		13.5
Idaho	206,182.04	204,994.04		1.2
Illinois	1,016,233.62	1,016,233.62		7.0
Indiana	996,082.11	996,082.11		19.1
Iowa	848,067.63	795,665.00		17.1
Kansas	1,260,279.49	1,244,976.69		14.2
Kentucky	437,249.52	435,366.36		6.6
Louisiana	273,259.85	273,172.19		6.9

[1] No projects of this class under construction in Hawaii and the District of Columbia.
[2] No projects of this class under construction in States not listed, the District of Columbia, and Hawaii.

TABLE 17.—*Total cost and mileage of 1935 Public Works highway projects financed with funds provided by the Hayden-Cartwright Act of June 18, 1935, under construction on June 30, 1935, and Federal funds allotted thereto, by States*—Con.

PROJECTS ON EXTENSIONS OF THE FEDERAL-AID SYSTEM INTO AND THROUGH MUNICIPALITIES—Continued

State	Estimated total cost	Federal funds allotted		Mileage
		Public Works funds	Federal-aid funds	
Maine	$197,218.30	$197,218.30		2.0
Massachusetts	230,205.73	230,205.73		2.4
Michigan	1,316,500.00	1,291,100.00		15.4
Minnesota	445,116.77	436,916.77		16.5
Mississippi	106,745.37	106,745.37		6.9
Missouri	157,129.26	157,129.26		4.4
Montana	31,670.98	31,670.98		2.1
Nebraska	531,566.36	531,566.36		8.9
Nevada	8,510.76	8,510.76		.6
New Hampshire	79,386.37	79,176.37		2.1
New Jersey	879,675.15	641,127.27	$19,000.00	4.8
New Mexico	69,432.03	69,432.03		1.7
New York	3,065,679.55	3,009,990.00		21.7
North Carolina	472,005.07	472,005.07		11.8
North Dakota	157,735.14	157,735.14		7.8
Ohio	1,661,797.00	1,533,452.00	6,030.00	15.4
Oklahoma	573,543.63	573,543.63		6.4
Oregon	591,819.38	591,819.38		9.9
Pennsylvania	1,006,691.49	972,115.31		12.7
Rhode Island	141,760.07	141,760.07		1.5
South Carolina	171,375.71	171,375.71		4.5
South Dakota	159,511.02	159,511.02		3.3
Tennessee	388,241.06	388,241.06		4.1
Texas	734,017.70	713,845.68	20,000.00	14.6
Utah	371,312.27	315,800.00		9.0
Vermont	163,645.98	149,376.31		2.4
Virginia	428,767.06	368,145.59	23,375.34	5.6
Washington	406,596.64	406,596.64		6.0
West Virginia	14,491.67	14,491.67		.7
Wisconsin	994,290.48	994,290.48		15.0
Wyoming	14,133.72	14,132.00		1.2
Total	25,013,629.41	23,092,394.26	119,576.41	339.5

PROJECTS ON SECONDARY OR FEEDER ROADS[3]

Alabama	$635,657.33	$635,657.33		44.1
Arizona	768,207.39	694,494.21		63.5
Arkansas	533,651.48	531,638.74		75.2
California	1,361,983.23	1,283,365.22		41.9
Colorado	621,244.72	504,962.72		66.7
Connecticut	222,880.06	222,880.06		4.5
Delaware	81,141.70	70,330.50		17.4
Florida	580,943.52	580,943.52		34.4
Georgia	342,922.74	342,922.74		29.6
Idaho	510,165.83	510,165.83		59.6
Illinois	3,004,914.00	3,004,914.00		145.3
Indiana	78,287.21	78,287.21		6.6
Iowa	1,425,508.86	1,222,625.00		246.5
Kansas	1,181,056.87	1,181,056.87		72.1
Kentucky	1,269,275.22	1,191,634.94		156.7
Louisiana	589,699.79	589,699.79		27.5
Maine	155,426.77	117,980.30		8.1
Maryland	378,167.35	378,167.35		15.5
Massachusetts	415,063.21	415,063.21		10.4
Michigan	1,458,017.00	1,458,017.00		63.0
Minnesota	929,772.62	824,872.62		95.7
Mississippi	62,278.91	62,278.91		11.3
Missouri	1,435,426.48	1,426,306.28		286.4
Montana	438,840.01	438,840.01		46.2
Nebraska	430,844.61	430,844.61		67.8
Nevada	244,477.73	244,477.73		24.5
New Hampshire	210,542.17	206,407.78		7.6
New Jersey	107,524.70	107,524.70		1.7
New Mexico	383,701.28	383,701.28		47.4
New York	3,954,270.00	3,403,050.00		267.8
North Carolina	966,921.63	966,921.63		117.5

[3] No projects of this class under construction in Hawaii.

TABLE 17.—*Total cost and mileage of 1935 Public Works highway projects financed with funds provided by the Hayden-Cartwright Act of June 18, 1934, under construction on June 30, 1935, and Federal funds allotted thereto, by States*—Con.

PROJECTS ON SECONDARY OR FEEDER ROADS—Continued

State	Estimated total cost	Federal funds allotted		Mileage
		Public Works funds	Federal-aid funds	
North Dakota	$41,994.39	$41,994.39		8.4
Ohio	1,440,226.44	1,390,842.91		90.3
Oklahoma	1,002,140.73	854,359.84		34.6
Oregon	411,551.66	357,138.77		21.7
Pennsylvania	2,325,212.07	2,275,713.75		103.5
Rhode Island	212,562.56	212,562.56		6.7
South Carolina	1,114,812.40	1,076,462.78		125.2
South Dakota	288,987.69	288,987.69		63.7
Tennessee	568,686.82	568,686.82		27.4
Texas	2,876,616.78	2,876,596.78		167.2
Utah	371,555.10	314,372.75		59.0
Vermont	197,198.91	182,947.63		13.7
Virginia	590,165.00	582,891.97		61.2
Washington	556,609.68	549,109.68		24.1
West Virginia	301,156.98	301,156.98		11.7
Wisconsin	1,490,418.47	1,361,660.19		43.7
Wyoming	332,065.94	332,063.00		67.0
District of Columbia	337,624.96	337,624.96		2.7
Total	39,238,401.00	37,415,205.54		3,094.3

Of the 1,427 miles in projects approved for construction on June 30, 675 miles were located on the Federal-aid highway system outside of cities; 135 miles were made up of municipal extensions of the system; and 617 miles consisted of secondary or feeder roads. The distribution of these projects and other information concerning them are given in tables 18 and 19.

TABLE 18.—*Total cost and mileage of 1934 Public Works highways financed with funds provided by sec. 204 of the National Industrial Recovery Act, approved for construction on June 30, 1935, and Federal funds allotted thereto, by States*

PROJECTS ON THE FEDERAL-AID SYSTEM OUTSIDE OF MUNICIPALITIES [1]

State	Estimated total cost	Federal funds allotted		Mileage
		Public Works funds	Federal-aid funds	
Alabama	$37,465.80	$37,465.80		
Arkansas	159,288.77	158,918.77		4.0
Colorado	77,584.98	6,627.34		5.5
Delaware	4,158.00	4,082.00		
Georgia	6,393.86	6,393.86		
Illinois	3,000.00	3,000.00		.1
Indiana	77,950.96	77,950.96		
Louisiana	11,069.97	11,069.97		.1
Maryland	106,646.45	106,646.45		1.1
Minnesota	50,481.59	50,481.59		5.4
Mississippi	5,574.32	5,574.32		
Nevada	70,539.91	34,908.23		25.8
North Carolina	64,450.00	64,450.00		
North Dakota	198,227.80	148,356.30	$49,871.50	65.9
Ohio	44,210.00	42,800.00		.7
Oklahoma	16,345.48	10,819.53		.1
Pennsylvania	2,291.36	2,126.23		
South Carolina	18,520.00	18,520.00		
South Dakota	21,653.14	17,186.63	4,466.51	5.9
Tennessee	2,195.35	2,195.35		
Virginia	127,423.27	51,679.64	9,722.83	4.8
West Virginia	57,990.03	54,406.80		.5
Wisconsin	79,906.70	25,000.00		2.0
Hawaii	20,972.60	20,972.60		.1
Total	1,264,340.34	961,632.37	64,060.84	122.0

[1] No projects of this class in this status in States not listed and the District of Columbia.

TABLE 18.—*Total cost and mileage of 1934 Public Works highways financed with funds provided by sec. 204 of the National Industrial Recovery Act, approved for construction on June 30, 1935, and Federal funds allotted thereto, by States*—Con.

PROJECTS ON EXTENSIONS OF THE FEDERAL-AID SYSTEM INTO AND THROUGH MUNICIPALITIES[2]

State	Estimated total cost	Federal funds allotted		Mileage
		Public Works funds	Federal-aid funds	
Alabama	$29,877.89	$29,877.89		
Arizona	129,321.66	129,321.66		0.1
Arkansas	101,076.31	101,076.31		.2
Colorado	15,949.45	15,949.45		.8
Illinois	47,260.00	47,260.00		.6
Indiana	148,114.62	148,114.62		1.6
Kansas	48,918.42	48,918.42		1.3
Kentucky	35,577.81	30,000.00		
Louisiana	10,665.82	10,665.82		
Maine	58,912.31	58,912.31		.7
Michigan	19,400.00	19,400.00		.7
Minnesota	2,310.00	2,310.00		
Mississippi	9,152.16	9,152.16		.3
Montana	30,011.74	30,011.74		2.3
New Mexico	1,010.05	1,010.05		
New York	76,700.00	76,700.00		
North Carolina	91,217.00	91,217.00		.1
North Dakota	119,304.45	119,304.45		7.4
Ohio	121,000.00	93,351.86		1.1
Oklahoma	57,563.80	35,870.76		.7
Oregon	517.97	517.97		
South Carolina	26,797.84	19,297.84	$7,500.00	
South Dakota	55,948.23	55,948.23		1.5
Tennessee	11,070.59	11,070.59		.7
Texas	52,836.01	52,836.01		.5
Virginia	14,212.90	13,975.31		.1
West Virginia	39,253.65	28,642.41	10,611.24	.6
Wisconsin	57,664.33	57,664.33		.8
Wyoming	6,658.19	6,658.19		.4
Total	1,418,303.20	1,345,035.38	18,111.24	22.5

PROJECTS ON SECONDARY OR FEEDER ROADS[2]

Arizona	$66,269.29	$45,000.00		6.2
Colorado	3,197.17	3,197.17		.6
Illinois	9,847.75	9,847.75		8.3
Kansas	43,498.81	43,498.81		1.6
Louisiana	127,387.43	127,387.43		3.9
Maryland	13,941.95	9,800.00		1.5
Nevada	28,163.30	20,813.31		11.2
North Dakota	78,423.37	78,423.37		26.2
Ohio	17,000.00	17,000.00		2.0
South Carolina	36,000.00	36,000.00		5.9
Tennessee	17,894.47	17,894.47		.5
Texas	28,743.13	18,000.00		9.9
Virginia	74,549.90	65,504.17		1.7
Wyoming	42,657.78	41,790.00		22.0
Total	587,574.35	534,156.48		101.5

[2] No projects of this class in this status in States not listed, the District of Columbia, and Hawaii.

TABLE 19.—*Total cost and mileage of 1935 Public Works highways financed with funds provided by the Hayden-Cartwright Act of June 18, 1934, approved for construction on June 30, 1935, and Federal funds allotted thereto, by States*

PROJECTS ON THE FEDERAL-AID SYSTEM OUTSIDE OF MUNICIPALITIES [1]

State	Estimated total cost	Federal funds allotted		Mileage
		Public Works funds	Federal-aid funds	
Alabama	$459,429.26	$459,429.26		15.5
Arkansas	138,897.46	138,897.46		5.8
California	873,410.05	826,273.20		21.3
Delaware	7,441.50	7,441.50		
Florida	214,469.80	214,469.80		1.7
Georgia	240,661.00	240,661.00		4.6
Idaho	331,023.33	283,675.90		13.7
Illinois	280,271.00	277,997.66		.3
Indiana	601,199.50	383,180.35		21.8
Iowa	60,517.39	56,500.00		4.0
Kansas	27,300.37	27,188.53		1.3
Kentucky	260,116.82	234,306.90		11.2
Louisiana	1,326.42	1,326.42		.1
Maine	192,303.41	192,288.71		6.8
Massachusetts	5,350.56	5,350.56		
Michigan	579,025.00	579,025.00		26.6
Minnesota	286,751.73	284,628.56		36.3
Mississippi	694,396.44	684,578.30		34.6
Missouri	1,127,079.33	1,013,600.39		41.0
Montana	129,644.78	129,644.78		.2
Nebraska	40,817.00	40,817.00		.4
Nevada	259,726.99	234,342.21		34.5
New Jersey	10,167.47	10,167.47		
New Mexico	303,654.41	301,364.07		18.6
New York	26,900.00	26,900.00		
North Carolina	377,705.56	367,268.70		19.0
North Dakota	323,136.54	258,265.54	$64,871.00	91.7
Ohio	4,070.00	3,420.00		.1
Oklahoma	367,151.21	367,151.21		11.1
Pennsylvania	8,497.72	6,816.00		
South Carolina	27,220.10	27,220.10		.3
South Dakota	283,886.49	272,886.49	11,000.00	31.1
Tennessee	412,889.66	412,889.66		9.1
Texas	810,726.03	658,162.52		47.1
Utah	22,528.72	15,000.00		1.1
Vermont	82,679.65	68,421.44		1.7
Virginia	233,021.50	189,120.82	42,426.89	8.6
Washington	130,298.52	130,298.52		.3
West Virginia	119,086.55	119,086.55		4.2
Wisconsin	95,747.24	92,795.83		4.8
Wyoming	158,392.71	158,392.00		20.9
Hawaii	273,416.37	273,416.37		1.6
Total	10,882,335.59	10,074,666.78	118,297.89	553.0

PROJECTS ON EXTENSIONS OF THE FEDERAL-AID SYSTEM INTO AND THROUGH MUNICIPALITIES [2]

Alabama	$134,766.13	$134,766.13		2.0
Arizona	138,364.63	110,505.00		.1
Arkansas	200,919.11	200,693.61		4.3
California	105,954.28	100,000.00		1.6
Connecticut	134,613.11	134,613.11		1.3
Georgia	149,961.03	143,961.03		3.0
Illinois	613,618.00	613,618.00		2.6
Indiana	835,239.08	835,239.08		10.3
Iowa	166,512.39	158,535.00		1.4
Kansas	10,979.98	10,979.98		
Kentucky	242,923.86	215,702.18		3.9
Louisiana	272,960.25	272,960.25		3.6
Maine	286,017.87	280,253.42		3.2
Massachusetts	38,076.83	38,076.83		.7
Michigan	120,500.00	120,500.00		1.6
Minnesota	12,581.19	12,581.19		1.3
Mississippi	30,896.51	30,896.51		1.3
Missouri	747,677.05	743,232.48		5.4
Montana	7,552.82	7,552.82		.7
Nebraska	343.81	343.81		
New Hampshire	50,934.65	50,934.65		.3
New Jersey	119,047.71	104,945.64		
New York	62,000.00	62,000.00		

[1] No projects of this class in this status in States not listed and the District of Columbia.
[2] No projects of this class in this status in States not listed, the District of Columbia, and Hawaii.

TABLE 19.—*Total cost and mileage of 1935 Public Works highways financed with funds provided by the Hayden-Cartwright Act of June 18, 1934, approved for construction on June 30, 1935, and Federal funds allotted thereto, by States*—Con.

PROJECTS ON EXTENSIONS OF THE FEDERAL-AID SYSTEM INTO AND THROUGH MUNICIPALITIES—Continued

State	Estimated total cost	Federal funds allotted		Mileage
		Public Works funds	Federal-aid funds	
North Carolina	$135,599.56	$135,599.56		3.8
North Dakota	177,547.15	177,547.15		12.0
Ohio	191,200.00	191,200.00		1.3
Oklahoma	129,270.52	129,270.52		2.0
Oregon	116,472.40	80,000.00		.2
Pennsylvania	288,956.14	288,881.34		.9
South Carolina	103,791.13	103,791.13		1.2
South Dakota	104,395.23	104,395.23		5.6
Tennessee	355,676.78	355,676.78		3.1
Texas	569,417.84	476,685.37		12.6
Utah	185,933.96	152,000.00		4.8
Vermont	29,577.46	27,844.26		.9
Virginia	303,594.12	288,438.77		7.5
Washington	43,513.24	43,513.24		.2
West Virginia	216,075.42	216,075.42		3.4
Wisconsin	238,352.41	238,352.41		3.9
Total	7,676,863.65	7,392,161.90		112.0

PROJECTS ON SECONDARY OR FEEDER ROADS [2]

Alabama	$194,367.07	$194,367.07		12.0
Arizona	10,000.37	10,000.37		.9
Arkansas	173,729.35	173,440.85		24.4
California	474,025.01	455,377.32		14.8
Colorado	89,215.70	89,215.70		.6
Florida	125,376.15	103,590.73		6.8
Georgia	158,613.12	158,613.12		5.9
Illinois	994,669.61	994,669.61		19.1
Indiana	30,838.97	30,838.97		5.7
Iowa	152,358.51	51,400.00		16.3
Kansas	8,146.90	8,146.90		
Kentucky	52,920.99	49,903.55		4.7
Louisiana	129,771.72	129,771.72		5.4
Maryland	176,375.65	176,375.65		2.6
Massachusetts	115,369.59	115,369.59		5.5
Michigan	115,425.00	115,425.00		12.9
Minnesota	70,695.43	70,695.43		7.7
Mississippi	133,134.20	133,134.20		14.1
Missouri	698,342.98	698,342.98		110.6
Montana	42,981.12	42,981.12		5.2
Nebraska	37,135.70	37,135.70		4.6
New Mexico	73,134.74	73,134.74		2.6
North Carolina	120,716.85	120,716.85		5.4
North Dakota	196,748.61	196,748.61		44.5
Ohio	27,200.00	27,200.00		6.2
Oklahoma	91,282.66	91,282.66		8.7
Rhode Island	36,815.04	36,815.04		1.4
South Carolina	99,939.65	99,939.65		8.3
South Dakota	228,182.75	228,182.75		71.1
Tennessee	106,608.97	106,608.97		5.5
Texas	316,776.54	226,000.00		18.3
Utah	34,437.15	25,000.00		2.9
Virginia	257,744.14	239,410.85		22.0
West Virginia	93,523.82	93,523.82		9.9
Wisconsin	247,493.39	213,228.93		6.2
Wyoming	83,413.14	83,411.91		22.9
Total	5,997,510.59	5,700,000.36		515.7

[2] No projects of this class in this status in States not listed, the District of Columbia, and Hawaii.

The classification of the mileage of Public Works highway projects by surface types is shown for each of the States and each class of project completed in table 20. Similar information concerning projects under construction at the end of the fiscal year is given in table 21, and projects approved for construction at the close of the year are shown in table 22.

TABLE 20.—*Mileage of 1934 and 1935 Public Works highway projects financed with funds provided by section 204 of the National Industrial Recovery Act and the Hayden-Cartwright Act of June 18, 1934, completed, by types of construction, by States, June 30, 1935*

PROJECTS ON THE FEDERAL-AID SYSTEM OUTSIDE OF MUNICIPALITIES

State	Graded and drained	Sand-clay		Gravel		Macadam		Low cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland-cement concrete	Block	Bridges and approaches	Total	Grade-separation structures (mileage shown with bridges)	
		Untreated	Treated	Untreated	Treated	Untreated	Treated								Railroad-highway	Highway-highway
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Number*	*Number*
Alabama	18.3		35.3	13.6	44.9			128.7		30.1	67.8		1.5	340.2	1	
Arizona	23.0			113.1				205.3		7.4	.8		3.0	352.6	4	
Arkansas	13.9			64.7				9.0		25.6	49.5		2.4	165.1	3	
California	18.2			49.0	30.0		15.7	90.3	5.4	114.1	38.5		2.9	364.1	7	3
Colorado	5.3			222.5				2.7			9.8		2.6	242.9	17	
Connecticut				3.8					7.7		2.9		.1	14.5		
Delaware	5.3									.3	39.9		.1	45.6		
Florida	19.8						41.4	31.0			33.1		.3	125.6	1	
Georgia	21.6		45.4	39.9	79.7		57.7	20.2		5.0	47.4		2.1	319.0	2	
Idaho	7.5			103.0				81.6		.5	5.4		.5	198.5	2	
Illinois	2.2										30.9	1.8	5.4	40.3	25	1
Indiana	18.1			5.0						1.6	86.9		1.3	112.9	4	
Iowa	109.8			70.9				5.0			128.7		2.9	317.3	9	
Kansas	293.3	248.8		37.1							52.3	3.3	2.6	637.4	1	
Kentucky	39.6			103.0				53.4		13.8	69.7		1.0	280.5	2	
Louisiana	9.1			2.3	7.5			.5			55.2		2.2	76.8		
Maine					17.3				21.8	5.9	1.8		.6	47.4		
Maryland				.4					.2	9.6	5.2		.1	15.5		
Massachusetts									26.8	1.6	8.9		.1	37.4	1	
Michigan	28.9			75.7						.5	128.5		.6	234.2	1	
Minnesota	125.7			567.4	47.0	53.6		44.4	11.3		60.2		.5	910.1	14	
Mississippi	154.1		10.4	19.3	12.8						68.8		3.8	269.2	4	
Missouri	11.1			30.7						9.6	145.7		1.0	198.1	7	
Montana	30.6			429.8				92.4			9.2		2.4	564.4	11	1
Nebraska	93.5	117.2						56.4			99.8	.9	1.6	369.4	2	
Nevada				110.8				210.4		.6			.7	322.5	4	
New Hampshire							5.2		2.5	.9	3.1		.9	12.6	2	
New Jersey	.4										36.9		.1	37.4	3	
New Mexico	12.4			32.3	171.6			111.6		32.8	1.1		2.1	363.9	4	
New York	12.7			2.4				.1		43.9	164.0		.9	224.0	7	2
North Carolina	14.8	52.7	185.7	18.4	113.0	46.8	67.7	53.3		21.4	27.8		1.1	602.7	3	
North Dakota	463.3			568.8				89.7					.6	1,122.4	4	
Ohio	1.1			15.6					15.7	27.3	113.5	18.6	3.4	195.2		

Oklahoma	182.8			31.8	22.9					34.0	38.8	4.9	2.9	318.1	4	
Oregon	27.0			16.4	11.2	.1	5.9		108.8	9.2	13.8		1.5	193.9	3	
Pennsylvania	9.8								8.7	29.8	90.5		1.1	139.9	2	1
Rhode Island									8.5	1.8	10.2			20.5		
South Carolina	14.6		167.0					15.9	3.0		15.6		.9	217.0	6	
South Dakota	25[illegible]			174.0				101.4			26.5		.7	556.1	1	
Tennessee	49.4			9.8				5.1	1.2	17.3	107.9		1.5	192.2	3	
Texas	650.3			138.7	132.1		7.4	11.3		51.2	117.0	2.1	7.6	1,117.7	14	
Utah				33.3				180.7		23.7	35.5		.7	273.9	3	
Vermont				9.1				28.5	2.7		7.4		.3	48.0		
Virginia	12.1	1.8	39.6		.4	4.2	78.1	5.0		4.2	17.3		2.4	165.1	13	
Washington	20.8			42.3				.5			41.8		1.0	106.4	5	
West Virginia	23.6			.2			10.0			.1	44.9		.5	79.3	3	
Wisconsin	7.3			41.7				37.0		12.3	115.4		1.1	214.8	7	1
Wyoming	17.3			161.1	4.4			332.2			.3		.5	515.8	1	
Hawaii									19.2				.1	19.3		
Total	2,822.1	420.5	483.4	3,357.9	694.8	104.7	289.1	2,003.6	243.5	536.1	2,276.2	31.6	74.2	13,337.7	210	9

PROJECTS ON EXTENSIONS OF THE FEDERAL-AID SYSTEM INTO AND THROUGH MUNICIPALITIES

Alabama			4.9	0.5	1.0		1.3	13.4		5.9	18.1	0.8	0.2	46.1	4	
Arizona								5.9	0.6	3.9	3.7		.1	14.2	2	
Arkansas	0.2			2.0				1.9		10.1	29.8		.4	44.4	1	
California								4.0		40.1	15.5		.6	60.2	2	7
Colorado				3.1			1.1	2.0	3.7	13.4	16.1		.5	39.9	3	
Connecticut									.5	6.0	3.7			10.2		
Delaware										2.2	5.1			7.3		
Florida	1.4						3.9			.5	15.2		.4	21.4	4	
Georgia	1.9		4.9	6.7	9.7		23.1	1.1		1.5	19.2	.7	1.2	70.0	6	
Idaho				5.4				7.5		4.8	2.2		.2	20.1	3	
Illinois										16.9	40.7	7.7	1.1	66.4	13	
Indiana								1.5		29.7	31.9		.7	63.8	1	
Iowa	8.0			5.2				.9			37.2	4.4	1.7	57.4	10	
Kansas	7.2	5.3		.3				.5		4.7	19.5	4.2	.6	42.3	4	
Kentucky	1.4			.9				5.6		11.5	14.6		.2	34.2		
Louisiana	3.5			.4	1.2						14.9		.2	20.2	1	
Maine					1.4					8.0	2.5		.1	16.4		
Maryland											3.6			3.6		
Massachusetts										4.1	3.5	4.0	.8	1.0	13.4	1	1
Michigan	1.1										13.1	24.5	.6	.3	39.6	3	
Minnesota	15.0			44.7	4.0	2.2		7.5	1.6	9.2	24.6	1.3	.7	110.8	14	
Mississippi	11.1		3.2	.8	3.9					.2	11.4	1.2	.2	32.0	3	
Missouri	1.6			2.5	.4			3.0		11.0	32.5		.9	51.9	5	
Montana				8.8				15.7		5.7	3.6		.2	34.0	4	
Nebraska	4.0	3.3						.8		2.4	27.3	2.9	.2	40.9	2	1
Nevada								2.7		5.1	2.4			10.2		
New Hampshire									2.4		14.5			16.9		
New Jersey	.7									1.4	20.0	.7	.1	22.9	2	3
New Mexico					19.6			9.2		4.2	5.0		1.0	39.0	5	
New York	8.0									16.6	34.2	.7	.9	60.4	5	14

TABLE 20.—*Mileage of 1934 and 1935 Public Works highway projects financed with funds provided by section 204 of the National Industrial Recovery Act and the Hayden-Cartwright Act of June 18, 1934, completed, by types of construction, by States, June 30, 1935*—Continued

PROJECTS ON EXTENSIONS OF THE FEDERAL-AID SYSTEM INTO AND THROUGH MUNICIPALITIES—Continued

State	Graded and drained	Sand-clay		Gravel		Macadam		Low cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total	Grade-separation structures (mileage shown with bridges)	
		Untreated	Treated	Untreated	Treated	Untreated	Treated								Railroad-highway	Highway-highway
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Number*	*Number*
North Carolina	1.3	2.2	12.0	0.7	6.6	0.6	4.4	3.1	1.4	24.8	34.2		0.4	91.7	9	
North Dakota	6.7			8.4				18.7		3.2	9.4		.2	46.6	2	
Ohio	.9			.4					1.0	19.8	21.9	20.3	.8	65.1	1	
Oklahoma	4.7			1.6						11.9	29.3	.5	.3	48.3	2	
Oregon	.6			1.2	1.7		.5		4.2	8.5	14.1		.4	31.2	3	1
Pennsylvania							.2		3.0	23.0	39.1	3.3	.8	69.4	4	
Rhode Island									3.6	2.7	1.1			7.4		
South Carolina	1.5		13.4					3.2		7.8	8.5		.1	34.5	3	
South Dakota	3.5			1.6				6.3			24.8		.6	36.8	2	
Tennessee	.5			.3					1.3	8.3	14.3	1.1	.1	25.9	2	
Texas	25.2			9.4	25.2		3.9			24.1	38.0	1.6	1.4	128.8	19	
Utah				.9				1.5		2.7	14.7		.4	20.2	1	
Vermont				.4				1.4	1.8	2.6	8.0		.2	14.4		
Virginia		1.5	1.8		.7	1.0	10.6		.4	8.5	4.8	.6	.6	30.5	5	
Washington	1.5			3.6					1.4	7.7	25.6		.6	40.4	4	1
West Virginia				1.5			.7			6.1	8.8		.6	17.7	1	
Wisconsin	2.1			5.8				2.0		7.2	37.1		1.3	55.5	2	
Wyoming								8.7	9.5		4.2		.1	22.5		
District of Columbia										3.8	2.7			6.5		
Total	113.6	12.3	40.2	117.1	75.4	3.8	49.7	128.1	48.5	402.4	836.4	53.4	22.6	1,903.5	158	28

PROJECTS ON SECONDARY OR FEEDER ROADS

Alabama	9.4	23.8	22.0	40.6	6.2	8.7	0.8	3.0			0.3		1.4	116.2	3	
Arizona	16.5			9.0				39.2					.6	65.3	2	
Arkansas				148.0							.2		.9	149.1		
California	22.9			17.6	11.8			98.3		18.2			1.6	170.4		
Colorado	11.2			220.2									.6	232.0		
Connecticut									3.5					3.5		
Delaware				49.6						.9	.9		.1	51.5		1

Florida	23.8		7.4				34.0	22.1			.8		.4	88.5		
Georgia	8.7	7.6		72.0	20.9		4.1	4.6			4.2		1.0	122.1	2	
Idaho				135.3				28.5					.3	164.1		
Illinois	11.8			115.7				6.7			23.0		2.8	160.0	12	
Indiana				32.2	1.4			7.3			3.1		.1	44.1		
Iowa	219.6			150.2				29.6			12.6		1.4	413.4	2	
Kansas	143.4	61.7		13.0				1.3			7.4		1.0	227.8	1	
Kentucky	114.4			108.2						3.0	12.1		.5	238.2	1	
Louisiana	1.1			10.7	14.6						23.5		.6	50.5	1	
Maine				95.8	1.9							0.1	.6	98.4		
Maryland	1.4	1.2	3.0	13.1	2.1		7.8	3.6	20.2	1.3	5.7		.1	59.5		
Massachusetts								3.7	11.5					15.2		
Michigan	14.4			152.8				.4		18.8	18.9		.4	205.7		
Minnesota	151.5			138.3				3.9			5.2		.5	299.4		
Mississippi	36.7	25.5		61.5	5.2								1.3	130.2		
Missouri	415.0			229.9				.8		.5	.5		2.1	648.8	1	
Montana	.3			237.1				25.2			1.1		.5	264.2	1	
Nebraska	160.2	233.6						9.0			17.2		.9	420.9		
Nevada				129.0				55.9					.5	185.4	1	
New Hampshire						.7	24.3		.5				.2	25.7		
New Jersey											.5			.5		
New Mexico	7.5	10.0		217.7	5.6								.4	241.2		
New York				12.5				6.2		19.0	54.8		.5	93.0		
North Carolina		82.6	90.3	53.2	23.9	11.4	9.5	17.6			1.2		.8	289.9		
North Dakota	77.7			243.9						.8				322.4		
Ohio	2.2			236.7	.9	8.3	.4	10.1	5.4	18.3	20.4	8.3	.8	311.8	1	
Oklahoma	31.8			175.7	13.6			11.7		36.3	.7		1.5	271.3	1	
Oregon	11.7			43.7	26.9		21.7		44.4	2.4			1.7	152.5	1	
Pennsylvania			3.1		32.6		189.6		306.4	8.5	14.1		.4	554.7	1	
Rhode Island					33.1									33.1		
South Carolina	14.5	7.1	98.9		3.6								.3	124.4		
South Dakota	68.5			328.7									.2	397.4		
Tennessee	6.3			50.6		.2		4.7	38.8	16.9	14.5		.6	132.6		
Texas	397.5			157.1	119.9		4.2	5.1	12.5	132.1	18.8		3.6	850.8	8	
Utah	8.9			150.3				31.7		1.6	2.8		.1	195.4	1	
Vermont	3.7			5.6				28.2	1.7				.3	39.5	1	
Virginia		42.3	56.1	29.7	26.6	5.2	16.5	31.5	2.9				1.0	211.8		
Washington	8.0			86.4					3.4	1.0	1.7		.2	100.7	2	
West Virginia				8.5		1.0	30.3		1.7		.4		.1	42.0		
Wisconsin	2.8			71.0				53.0			43.2		.4	170.4	1	
Wyoming				135.0	8.1			13.3					.4	156.8		
District of Columbia										4.2	6.0			10.2		
Hawaii									4.9					4.9		
Total	2,003.4	494.8	280.8	4,186.1	358.9	35.5	343.2	556.2	457.8	283.8	315.8	8.4	33.7	9,358.4	44	1

TABLE 21.—*Mileage of 1934 and 1935 Public Works highway projects financed with funds provided by section 204 of the National Industrial Recovery Act and the Hayden-Cartwright Act of June 18, 1934, under construction, by types of construction, by States, June 30, 1935*

PROJECTS ON THE FEDERAL-AID SYSTEM OUTSIDE OF MUNICIPALITIES

State	Graded and drained	Sand-clay		Gravel		Macadam		Low cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland-cement concrete	Block	Bridges and approaches	Total	Grade-separation structures (mileage shown with bridges)	
		Untreated	Treated	Untreated	Treated	Untreated	Treated								Railroad-highway	Highway-highway
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Number*	*Number*
Alabama	9.0	5.9	46.7	8.4	18.9		1.1	18.5		6.1	9.0		0.4	124.0	1	
Arizona	14.4			14.6				13.3					.1	42.4	1	
Arkansas	.1			34.2				1.6		29.2	23.8		1.1	90.0	1	
California	2.5				20.1			12.9		6.0	18.6		1.0	61.1		
Colorado				44.2									.3	44.5		
Connecticut									21.7		1.7			23.4		
Delaware											3.2			3.2		
Florida	3.8						10.3	15.0			.2		.9	30.2		
Georgia	8.5		8.4	13.5	14.4		29.9			15.1	14.5		.8	105.1	6	
Idaho	2.4			30.6									.3	33.3	2	
Illinois	43.3										18.8	2.4	2.6	67.1	12	1
Indiana	97.8			4.8							58.6		2.1	163.3	7	
Iowa	52.2			12.2							53.0		.7	118.1	1	
Kansas	105.0	1.0						7.9			9.3	1.0	1.0	125.2		
Kentucky	12.8			12.4				16.3		9.8	5.0		.4	56.7	2	
Louisiana	1.4			1.0	2.6			8.2			14.7		1.0	28.9	4	
Maine					2.7				7.0		.2		.2	10.1		
Maryland	13.3			3.1						1.7	3.1		.1	21.3	1	
Massachusetts									11.0	6.9	2.2		.1	20.2		
Michigan	48.1			43.1				.2		11.3	32.6		.5	135.8	4	
Minnesota	15.9			8.2		10.0		67.4		13.6	4.7		.1	119.9	2	
Mississippi	67.5		10.9	21.8	24.5					8.9	25.1		1.4	160.1	6	
Missouri	17.1			13.6							53.0		1.1	84.8	12	
Montana	12.5			20.4				37.9					.8	71.6		
Nebraska	63.1										40.4		1.5	105.0	3	
Nevada				75.3				24.4						99.7		
New Hampshire							8.7		1.9				.1	10.7		
New Jersey											15.1		.1	15.2	1	
New Mexico	4.6			20.9				19.0			.4		.1	45.0		
New York	14.0								14.6	13.0	94.9		.9	137.4	4	2
North Carolina	11.7	15.1	46.8	25.7	21.6		34.5				1.0		.3	156.7	2	
North Dakota	73.7			111.7				18.1					.1	203.6		

Ohio	2.2			4.8		.3				12.4	32.6	16.4	.4	69.1		
Oklahoma	43.0			3.4				2.9		5.2	23.4		2.0	79.9	3	
Oregon	8.7			18.5		17.1			9.5		1.3		.3	55.4		
Pennsylvania	.3								13.8	5.2	61.5		.3	81.1		
Rhode Island					2.8				6.9	1.3	3.3			14.3		
South Carolina	3.2		50.1					2.3					.1	55.7		
South Dakota	81.2			80.0				54.4			19.7		.1	235.4		
Tennessee	10.0			13.8						7.1	23.8		1.0	55.7	2	
Texas	86.9	12.0		87.3	92.4		2.4			5.1	85.2	.2	1.5	373.0	3	
Utah				13.0				10.1		2.5	3.5			29.1	1	
Vermont				7.8				8.4	1.2		.3			17.7		
Virginia	2.9		19.3	2.8			27.6				24.4		.2	77.2	2	
Washington	3.6			7.9						.1	10.5		1.5	23.6	2	
West Virginia				2.0							15.2			17.2		
Wisconsin	44.4			7.4				6.4		15.8	13.4		.1	87.5	1	
Wyoming	12.4			38.9	30.4			114.7					.4	196.8	2	
Hawaii									20.1				.2	20.3		
Total	993.5	34.0	182.2	807.3	230.4	27.4	114.5	459.9	107.7	176.3	821.2	20.0	28.2	4,002.6	88	3

PROJECTS ON EXTENSIONS OF THE FEDERAL-AID SYSTEM INTO AND THROUGH MUNICIPALITIES[1]

Alabama	2.1		5.9	0.5	5.1		0.4	7.6		0.9	3.6			26.1	1	
Arizona										.2	.3		0.1	.6	1	
Arkansas				.2			1.2	1.6		1.7	5.7		.2	10.6	2	
California								2.6		6.6	2.3		1.9	13.4	4	1
Connecticut										1.6				1.6		
Delaware											1.8			1.8		
Florida										.7	.7			1.4		
Georgia			1.4		1.7		11.2			1.1	5.6		.2	21.2	1	
Idaho				1.1							.2			1.3	1	
Illinois	1.0										8.2	1.2	.7	11.1	10	
Indiana	.3									4.0	21.1		2.9	28.3	5	1
Iowa	1.6			.6							18.6	1.1	1.4	23.3	5	
Kansas	1.4	1.1						.6		.9	9.3	1.0	.5	14.8	2	
Kentucky										3.8	4.7		.2	8.7		
Louisiana	8.8				.3						8.2		.3	17.6		
Maine									0.4	.6	1.9		.1	3.0		
Maryland										.4		.1	.4	.9		
Massachusetts									.8	1.0	2.8		1.2	5.8	1	3
Michigan	.1			.1						2.0	15.5		.1	17.8		
Minnesota	3.0			3.6				4.4		1.8	4.9		.1	17.8	3	
Mississippi	10.2		.9	1.3	3.6					4.2	6.5		.1	26.8	6	1
Missouri	.4			.5							10.0		.3	11.2	3	2
Montana				.8				5.8						6.6		
Nebraska	.4									.5	7.4		.6	8.9	2	
Nevada				.6										.6		
New Hampshire							3.8						.1	3.9		
New Jersey										.4	4.6		.1	5.1	3	

[1] No projects in this class in this status in Colorado and Hawaii.

TABLE 21.—*Mileage of 1934 and 1935 Public Works highway projects financed with funds provided by section 204 of the National Industrial Recovery Act and the Hayden-Cartwright Act of June 18, 1934, under construction, by types of construction, by States, June 30, 1935*—Continued

PROJECTS ON EXTENSIONS OF THE FEDERAL-AID SYSTEM INTO AND THROUGH MUNICIPALITIES—Continued

State	Graded and drained	Sand-clay		Gravel		Macadam		Low cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland-cement concrete	Block	Bridges and approaches	Total	Grade-separation structures (mileage shown with bridges)	
		Untreated	Treated	Untreated	Treated	Untreated	Treated								Railroad-highway	Highway-highway
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Number*	*Number*
New Mexico					2.3						0.5		0.1	2.9	1	
New York	4.5								4.2	3.4	13.4		.4	25.9	3	6
North Carolina	.4	0.7	2.4		.2		2.8			1.7	8.2		.2	16.6	2	
North Dakota	1.3			1.2				11.0			1.1	0.7		15.3		
Ohio	.3					0.2				4.9	4.1	5.6	.3	15.4		
Oklahoma	1.7				.4					.3	5.6		.5	8.5		
Oregon				.1					2.8	3.3	4.6		.1	10.9		
Pennsylvania									2.8	1.6	9.5	1.0	.2	15.1	2	
Rhode Island									.6	.9				1.5		
South Carolina	.2		5.8					.8		3.6	4.8		.1	15.3	2	
South Dakota	3.2			.3				2.3			4.4		.2	10.4	2	
Tennessee				.1						3.1	3.4		.2	6.8		
Texas	2.8			.5	6.6					1.5	8.9	1.4	.7	22.4	5	
Utah				1.4						5.0	3.0			9.4	2	
Vermont				.1				.5		.3	2.3		.1	3.3		
Virginia		.2				.7	3.1			3.3	1.3	.1	.5	9.2	1	
Washington				1.6						.9	4.4		.1	7.0	2	
West Virginia				1.6	.4						2.1		.1	4.2	2	
Wisconsin	.5			3.5				.6		1.3	8.8		.4	15.1	1	1
Wyoming								3.0						3.0		
District of Columbia										.1			.1	.2		
Total	44.2	2.0	16.4	19.7	20.6	.9	22.5	40.8	11.6	67.6	234.3	12.2	15.8	508.6	75	15

PROJECTS ON SECONDARY OR FEEDER ROADS[2]

Alabama	9.5	4.5	14.0	21.6	15.0			11.0			0.3		0.4	76.3		
Arizona	4.4			13.1				45.6			.1		.3	63.5	1	
Arkansas				85.8							1.0		.6	87.4		
California				1.3	12.7			30.9	0.3	9.2	3.4		.8	58.6	1	

Colorado				76.7									.1	76.8		
Connecticut									16.0					16.0		
Delaware				17.4							2.5			19.9		
Florida	7.5		8.0				13.3	5.4					.2	34.4		
Georgia			2.2	35.5	17.0		4.0	11.1			.4		.7	70.9	2	
Idaho				59.6										59.6		
Illinois	9.6			250.1				12.4			32.3	5.2	2.3	311.9	10	
Indiana	5.9			17.6	12.3			14.2						50.0		
Iowa	130.4			134.6							5.0		.6	270.6	1	
Kansas	57.0	12.6						.6			14.2		.3	84.7	2	
Kentucky	114.5			50.5				3.4					.3	168.7		
Louisiana	10.2			14.2	2.6						11.4		.4	38.8		
Maine				8.0									.1	8.1		
Maryland		.7		12.3	1.0				5.2		5.1			24.3		
Massachusetts									10.4					10.4		
Michigan	17.4			29.6				20.6		6.4	7.8		.2	82.0	1	
Minnesota	75.4			24.6									.2	100.2	5	
Mississippi	28.7			21.3									.7	50.7		
Missouri	113.1			187.1							1.0		1.5	302.7	2	
Montana				41.1				5.0					.1	46.2		
Nebraska	47.2	20.3											.3	67.8		
Nevada				21.5				3.0						24.5		
New Hampshire							8.9							8.9		
New Jersey											1.7			1.7		
New Mexico				55.6										55.6		
New York	.2			216.5	3.3		4.3	2.2	.2	9.0	47.4		.4	283.5	3	
North Carolina		56.7	20.6	11.6			18.3	18.3					.2	125.7		
North Dakota	26.4			82.5									.1	109.0		
Ohio				73.8				5.0	1.7	9.3	3.4	2.6	.1	95.9		
Oklahoma	10.6			30.6						10.8	.1		1.6	53.7		
Oregon	1.0			3.6	1.3	0.8	10.0	.9	3.9	.1			.3	21.9		
Pennsylvania					22.9		50.6		115.0	3.3	8.4		.2	200.4	1	
Rhode Island					5.7				1.0					6.7		
South Carolina		7.7	97.3					53.7					.2	158.9		
South Dakota	74.7			58.7									.2	133.6		
Tennessee	18.7			25.0			6.8						.8	51.3	1	
Texas	17.0			74.8	52.4					6.0	15.9		1.9	168.0		
Utah	6.2			44.2				20.4			.3			71.1		
Vermont				6.9		1.5		5.3						13.7		
Virginia	1.1	25.4	20.9	6.9	.4		9.8						.1	64.6		
Washington				13.4	2.0			2.8			5.7		.2	24.1	1	
West Virginia	8.7			3.4			12.9				1.7		.1	26.8		
Wisconsin	.5			39.5						3.1	16.6		.5	60.2	2	
Wyoming				15.3	56.1			4.1						75.5		
District of Columbia	.9									1.3	.5			2.7		
Total	796.8	127.9	163.0	1,885.8	204.7	2.3	138.9	275.9	153.7	58.5	186.2	7.8	17.0	4,018.5	33	

[2] No projects of this class in this status in Hawaii.

TABLE 22.—*Mileage of 1934 and 1935 Public Works highway projects financed with funds provided by section 204 of the National Industrial Recovery Act and the Hayden-Cartwright Act of June 18, 1934, approved for construction, by types of construction, by States, June 30, 1935*

PROJECTS ON THE FEDERAL-AID SYSTEM OUTSIDE OF MUNICIPALITIES[1]

State	Graded and drained	Sand-clay		Gravel		Macadam		Low cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Block	Bridges and approaches	Total	Grade-separation structures (mileage shown with bridges)	
		Untreated	Treated	Untreated	Treated	Untreated	Treated								Railroad-highway	Highway-highway
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Number*	*Number*
Alabama				13.5							1.9		0.1	15.5		
Arkansas				3.0						2.3	4.4		.1	9.8		
California	8.3							5.1			7.4		.5	21.3	1	
Colorado				5.5										5.5		
Florida	1.7													1.7		
Georgia				3.0						1.3			.3	4.6		
Idaho				13.5									.2	13.7		
Illinois											.3		.1	.4	3	
Indiana	13.5										8.3			21.8		
Iowa	3.5										.5			4.0		
Kansas	1.2							.1						1.3		
Kentucky	6.5			1.2							3.5			11.2		
Louisiana											.2			.2		
Maine					6.8									6.8		
Maryland											.2		.9	1.1		
Michigan				2.9						2.0	21.7			26.6		
Minnesota	.7			5.4				3.4		32.2				41.7		
Mississippi	3.6			11.5	15.0						4.1		.4	34.6		
Missouri	7.8			16.3				.1			16.8			41.0		
Montana													.2	.2		
Nebraska											.3		.1	.4		
Nevada								60.3						60.3		
New Mexico				18.6										18.6		
North Carolina		6.9		3.5				6.4			2.2			19.0		
North Dakota	24.2			93.5	32.4			7.5						157.6		
Ohio											.8			.8		
Oklahoma	6.8										4.2		.2	11.2		
South Carolina											.3			.3		
South Dakota	6.8			10.0				16.1			4.0		.1	37.0		

Tennessee				.7						8.4				9.1		
Texas				1.6	33.0					2.1	10.3		.1	47.1	2	
Utah				1.1										1.1		
Vermont								1.7						1.7		
Virginia			1.5			4.7					7.1		.1	13.4		
Washington	.2												.1	.3		
West Virginia							0.5				4.1		.1	4.7		
Wisconsin								3.8			3.0			6.8		
Wyoming	20.4							.4						20.9		
Hawaii									1.6				.1	1.7		
Total	105.2	6.9	1.5	204.8	87.2	4.7	.5	105.0	1.6	48.3	105.6		3.7	675.0	6	

PROJECTS ON EXTENSIONS OF THE FEDERAL-AID SYSTEM INTO AND THROUGH MUNICIPALITIES[1]

Alabama				0.6						1.0	0.4			2.0		
Arizona													0.2	.2	1	
Arkansas								1.2		.1	2.9		.3	4.5	2	
California										1.5	.1			1.6		
Colorado				.8										.8		
Connecticut										1.3				1.3		
Georgia				.6							2.4			3.0		
Illinois											3.1		.1	3.2	2	
Indiana	0.6							.2		1.4	9.4		.3	11.9		1
Iowa				.5							.8		.1	1.4		
Kansas											1.3			1.3		
Kentucky										.5	3.4			3.9	1	
Louisiana				.1							3.5			3.6		
Maine									0.2	2.8	.5		.4	3.9	1	
Massachusetts									.7					.7		
Michigan											2.3			2.3		
Minnesota	.7							.6						1.3		
Mississippi					0.4					.3	.9			1.6		
Missouri				1.9				.6		.8	2.0		.1	5.4		6
Montana				.7				2.3						3.0		
New Hampshire													.3	.3		
North Carolina				.3			0.4	.4		.6	2.1		.1	3.9	1	
North Dakota				7.0	.7			11.1			.5		.1	19.4	1	
Ohio										1.7		0.7		2.4		
Oklahoma											2.7			2.7		
Oregon													.2	.2	1	
Pennsylvania											.9			.9		
South Carolina			0.2							.9	.1			1.2	1	
South Dakota	1.4							2.2			3.5			7.1		
Tennessee										1.8	2.0			3.8		
Texas	1.0			1.6	4.0					2.7	3.6	.1	.1	13.1	4	

[1] No projects in this class in this status in States not listed and the District of Columbia.

TABLE 22.—*Mileage of 1934 and 1935 Public Works highway projects financed with funds provided by section 204 of the National Industrial Recovery Act and the Hayden-Cartwright Act of June 18, 1934, approved for construction, by types of construction, by States, June 30, 1935*—Continued

PROJECTS ON EXTENSIONS OF THE FEDERAL-AID SYSTEM INTO AND THROUGH MUNICIPALITIES—Continued

State	Graded and drained	Sand-clay		Gravel		Macadam		Low cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland-cement concrete	Block	Bridges and approaches	Total	Grade-separation structures (mileage shown with bridges)	
		Untreated	Treated	Untreated	Treated	Untreated	Treated								Railroad-highway	Highway-highway
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Number*	*Number*
Utah										2.6	2.2			4.8		
Vermont										.4	.5			.9		
Virginia			0.4				3.7			3.2	.3			7.6		
Washington											.2			.2		
West Virginia											4.0			4.0	1	
Wisconsin	0.6							1.2		.9	2.0			4.7		
Wyoming	.3							.1						.4		
Total	4.6		.6	14.1	5.1		4.1	19.9	0.9	24.5	57.6	0.8	2.3	134.5	16	7

PROJECTS ON SECONDARY OR FEEDER ROADS[2]

Alabama	2.7			8.3	0.9								0.1	12.0		
Arizona	.9			6.2										7.1		
Arkansas				23.9							0.4		.1	24.4		
California	.1			5.4	.4			7.3			1.4		.2	14.8		
Colorado				1.2										1.2		
Florida								6.8						6.8		
Georgia								4.2			1.7			5.9		
Illinois	2.8			15.3							8.3		1.0	27.4	1	
Indiana	4.9			.8										5.7		
Iowa	7.5			8.6									.2	16.3		
Kansas											1.6			1.6		
Kentucky	2.2							2.5						4.7		
Louisiana				.8	2.6						5.9			9.3		
Maryland				1.5							2.6			4.1		

Massachusetts								3.5	2.0					5.5		
Michigan				7.6						4.9	.4			12.9		
Minnesota	3.3			4.3									.1	7.7		
Mississippi	4.6			6.4	3.1									14.1		
Missouri	17.4			89.3							3.1		.8	110.6		
Montana				5.2										5.2		
Nebraska	4.3										.3			4.6		
Nevada								11.2						11.2		
New Mexico				2.6										2.6		
North Carolina		1.5	3.9											5.4		
North Dakota	58.8			11.9										70.7		
Ohio				4.2	4.0									8.2		
Oklahoma				8.7										8.7		
Rhode Island					1.4									1.4		
South Carolina		3.7	10.5											14.2		
South Dakota	44.3			26.8										71.1		
Tennessee				3.4			2.6							6.0		
Texas				8.0	9.9		3.5				6.7		1	28.2		
Utah				2.9										2.9		
Virginia			17.3	6.2									2	23.7		
West Virginia							2.6	7.2			.1			9.9		
Wisconsin				4.8							1.0		.4	6.2	1	
Wyoming				13.2	31.7									44.9		
Total	153.8	5.2	31.7	277.5	54.0		8.7	42.7	2.0	4.9	33.5		3.2	617.2	2	

[2] No projects in this class in this status in States not listed, the District of Columbia, and Hawaii.

It will be noted that the completed projects included 412 structures separating the grades of railroads and highways at intersections and 38 highway-highway grade-separation structures. In course of construction at the close of the year were 196 other railroad-highway grade-separation structures and 18 structures eliminating level intersections of highways. To these will be added the 24 railroad-highway and 7 highway-highway structures shown in table 22 as approved for construction to make up the total of 695 grade-crossing-eliminating structures included in the Public Works highway program up to the end of the year.

The number of projects of this character included in the program is evidence of the importance attributed to the elimination of accident hazards in preparing the program of work. In addition to the grade crossings eliminated by structures, many more have been avoided by relocation of the highways as part of the improvement to be made; and the ends of safety are also served by the widening of existing surfaces, the easing of curves and grades, the lengthening of sight distances, and other marked betterments that result from the improvements planned and in course of realization.

Other major objectives to which, subject always to the primary employment purpose, special effort has been directed include the closing of the remaining unimproved gaps in the Federal-aid highway system; and the provision of road facilities to aid in the better coordination of transportation, especially roads to local railroad stations and roads that will be capable of taking over the service heretofore rendered by nonpaying railroad branch lines.

Landscaping of a reasonable mileage of roadsides was one of the special objects sought in planning the program and the States were required to use at least 0.5 percent of the 1934 funds and 1 percent of the 1935 funds for this purpose. The total program—completed, under improvement, and planned—has included 582 roadside-improvement projects. These projects involve 1,831 miles that have or are to be improved at an average estimated cost of $1,654 per mile. The majority of these projects are located on main arteries of travel at the approaches to the more important communities. Experience with this work has been valuable in developing proper methods of treatment and a trained personnel to supervise future work.

CONSTRUCTION OF ROADS THROUGH PUBLIC LANDS AND FEDERAL RESERVATIONS

Special appropriations for the survey, construction, reconstruction, and maintenance of main roads through unappropriated or unreserved public lands, nontaxable Indian lands, and other Federal reservations except national forests have been made by five congressional acts passed up to the end of the the fiscal year 1935.

As reported last year, the first two of these appropriations, aggregating $5,000,000, were made by the Emergency Employment Act of December 20, 1930, and the Emergency Relief and Construction Act of 1932. To this sum the National Industrial Recovery Act added $5,000,000, the act approved June 19, 1934, $2,500,000, and the Hayden-Cartwright Act $2,500,000 for each of the fiscal years 1936 and 1937.

Of the total of $17,500,000 authorized, $10,000,000 was apportioned in prior fiscal years, $2,500,000 was apportioned on July 5, 1934, and $2,500,000 for the fiscal year 1936 was apportioned on June 4, 1935. Funds for 1937 have not been apportioned. A deduction of $125,000 for administrative purposes was made from the first $5,000,000 only. The States benefiting and the amounts of their apportionments are shown in table 23. The same table also shows the progress made toward expenditure of the funds in the several States. The size of the unobligated balance at the end of the fiscal year results from the new apportionment made on June 4.

TABLE 23.—*Status of appropriations for roads through public lands and Federal reservations, June 30, 1935*

State	Total sum apportioned	Sums allotted to projects—					Unobligated balance
		Not yet under construction	Under construction	Completed and finally inspected	Completed and final payment made	Total allotted	
Arizona	$2,174,530	$183,952.84	$191,912.10	$447,992.83	$987,490.47	$1,811,348.24	$363,181.76
California	1,380,414	46,043.01	293,363.73	----------	586,362.23	925,768.97	454,645.03
Colorado	562,610	----------	231,884.04	176,751.00	52,956.96	461,592.00	101,018.00
Idaho	805,790	----------	78,787.70	133,745.89	435,601.72	648,135.31	157,654.69
Montana	806,760	----------	137,901.00	----------	530,411.00	668,312.00	138,448.00
Nevada	3,254,815	19,209.80	507,216.30	582,700.79	1,554,040.14	2,663,167.03	591,647.97
New Mexico	1,202,724	----------	2,645.81	375,034.86	408,663.19	786,343.86	416,380.14
North Dakota	152,605	----------	26,941.57	26,237.63	33,606.04	86,785.24	65,819.76
Oklahoma	150,475	----------	23,053.96	19,811.02	84,448.02	127,313.00	23,162.00
Oregon	1,004,415	----------	189,329.87	----------	640,754.13	830,084.00	174,331.00
South Dakota	295,206	----------	133,010.00	----------	65,715.00	198,725.00	96,481.00
Utah	1,648,901	35,000.00	244,880.55	110,000.00	969,114.45	1,358,995.00	289,906.00
Washington	228,593	----------	52,420.20	----------	134,032.80	186,453.00	42,140.00
Wyoming	1,207,162	----------	117,101.00	----------	833,111.53	950,212.53	256,949.47
Total	14,875,000	284,205.65	2,230,447.83	1,872,274.02	7,316,307.68	11,703,235.18	3,171,764.82

RESTORATION OF FLOOD-DAMAGED ROADS

No addition has been made during the past year to the appropriations previously made for relief of States on account of damage to roads by floods. The Hayden-Cartwright Act authorized the Secretary of Agriculture to expend for that purpose not to exceed $10,000,000 of available funds in any emergency that might arise.

Of the various appropriations, those made to Vermont and New Hampshire and reported as expended in the last annual report are still the only ones completely expended. Of the appropriation to Kentucky, nearly $127,000 was paid during the year, and the unobligated balance was reduced by about $185,000.

In Missouri all available funds have been assigned to projects, and additional funds have been assigned to projects in Louisiana. There was no change in the status of the appropriations to Arkansas and Mississippi. The appropriations to these four States have no definite time of availability. Of the remaining appropriations, Florida's is unaltered in status since the previous year's report, and the availability of Alabama's unobligated balance of $1,137,416 lapsed on June 30, 1935. The status of these several appropriations on June 30, 1935, is shown in table 24.

TABLE 24.—*Flood relief appropriated, amounts paid to States, and the unobligated balance of the appropriation on June 30, 1935*

State	Appropriated	Paid to States	Unobligated balance
Vermont	$2,654,000.00	$2,654,000.00	----------
New Hampshire	653,300.00	653,300.00	----------
Kentucky	1,889,994.00	1,361,185.71	$444,415.39
Total	5,197,294.00	4,668,485.71	444,415.39
Arkansas	1,800,000.00	1,477,693.56	322,306.44
Louisiana	967,582.00	786,271.13	115,390.36
Mississippi	628,000.00	345,266.57	282,733.43
Missouri	258,418.00	119,428.31	----------
Total	3,654,000.00	2,728,659.57	720,430.23
Alabama	[1] 1,618,500.00	481,083.81	[2] 1,137,416.19
Georgia	[1] 505,167.50	465,228.21	[3] 20,835.35
South Carolina	[1] 801,361.00	799,161.00	----------
Florida	80,307.00	77,296.48	----------
Total	3,005,335.50	1,822,769.50	1,158,251.54
Grand total	11,856,629.50	9,219,914.78	2,323,097.16

[1] Does not include fund allowable for administration.
[2] Availability for obligation expired June 30, 1935.
[3] Availability for obligation expired June 30, 1934.

The mileage of road improved under the flood-relief acts up to the end of the fiscal year and the corresponding total cost and Federal payment are given in table 25. Similar information for roads completed and paid for during the past year is presented in table 26, and for roads under construction and approved for construction in table 27.

TABLE 25.—*Total cost, flood relief, and mileage improved to June 30, 1935*

State	Total cost	Flood relief	Miles
Vermont	$5,651,965.83	$2,654,000.00	61.2
New Hampshire	1,408,479.45	653,300.00	29.1
Kentucky	3,155,028.01	1,295,097.04	222.2
Total	10,215,473.29	4,602,397.04	312.5
Arkansas	843,914.04	405,711.21	49.8
Mississippi	11,433.59	3,563.66	.3
Total	855,347.63	409,274.87	50.1
Alabama	319,797.49	155,615.15	41.7
Georgia	414,095.59	199,950.06	5.1
South Carolina	1,737,926.92	801,361.00	22.3
Total	2,471,820.00	1,156,926.21	69.1
Grand total	13,542,640.92	6,168,598.12	431.7

TABLE 26.—*Total cost, flood relief, and mileage of roads which were completed and paid for during the fiscal year 1935*

State	Total cost	Flood relief	Miles		
			Initial	Stage	Total
Kentucky	$203,260.45	$81,613.09	12.9	14.8	27.7
Georgia	18,653.74	8,873.83	.4	----------	.4
South Carolina	345,492.21	163,939.02	3.9	----------	3.9
Total	364,145.95	172,812.85	4.3	----------	4.3
Grand total	567,406.40	254,425.94	17.2	14.8	32.0

TABLE 27.—*Total cost, flood relief, and mileage of roads finally inspected, under construction and approved for construction on June 30, 1935*

State	Total cost	Flood relief	Miles		
			Initial	Stage	Total
Kentucky	$367,728.80	$159,281.57	25.3	6.2	31.5
Louisiana	131,841.02	65,920.51	10.5	----------	10.5
Missouri	291,568.03	130,865.95	3.0	6.3	9.3
Total	423,409.05	196,786.46	13.5	6.3	19.8
Georgia	70,249.18	31,178.18	.8	----------	.8
South Carolina	68,092.45	29,800.00	.2	----------	.2
Total	138,341.63	60,978.18	1.0	----------	1.0
Grand total	929,479.48	417,046.21	39.8	12.5	52.3

The mileage of the several surface types represented in flood-relief roads completed and fully paid for during the fiscal year 1935 is given in table 28, and the total mileages completed, and under construction or approved for construction at the close of the fiscal year are given in tables 29 and 30, respectively.

TABLE 28.—*Mileage of various types of flood-relief roads completed and paid for during the fiscal year 1935*

State	Graded and drained	Sand-clay untreated	Gravel untreated	Bridges and approaches	Total		
					Initial	Stage	Total
Kentucky	4.0		23.6	0.1	12.9	14.8	27.7
Georgia		0.4			.4		.4
South Carolina	2.9	.3		.7	3.9		3.9
Total	2.9	.7		.7	4.3		4.3
Grand total	6.9	.7	23.6	.8	17.2	14.8	32.0

TABLE 29.—*Mileage of the various types of flood-relief roads improved to June 30, 1935*

State	Graded and drained	Sand-clay untreated	Gravel, untreated	Gravel, surface treated	Macadam, surface treated	Bituminous macadam	Portland-cement concrete	Bridges and approaches	Total
Vermont			7.0	9.2		6.1	32.5	6.4	61.2
New Hampshire				2.9	4.9	2.3	18.4	.6	29.1
Kentucky	207.0		13.6					1.6	222.2
Total	207.0		20.6	12.1	4.9	8.4	50.9	8.6	312.5
Arkansas	16.1		31.1				.3	2.3	49.8
Mississippi							.3		.3
Total	16.1		31.1				.6	2.3	50.1
Alabama	17.4	15.9	7.6					.8	41.7
Georgia		.4			3.3		.6	.8	5.1
South Carolina	12.9	.3					5.3	3.8	22.3
Total	30.3	16.6	7.6		3.3		5.9	5.4	69.1
Grand total	253.4	16.6	59.3	12.1	8.2	8.4	57.4	16.3	431.7

TABLE 30.—*Mileage of the various types of flood-relief roads finally inspected, under construction and approved for construction on June 30, 1935*

State	Graded and drained	Untreated gravel	Treated macadam	Portland-cement concrete	Bridges and approaches	Total		
						Initial	Stage	Total
Kentucky	25.1	6.2			0.2	25.3	6.2	31.5
Louisiana		10.5				10.5		10.5
Missouri		6.6		2.4	.3	3.0	6.3	9.3
Total		17.1		2.4	.3	13.5	6.3	19.8
Georgia			0.3	.4	.1	.8		.8
South Carolina	.1				.1	.2		.2
Total	.1		.3	.4	.2	1.0		1.0
Grand total	25.2	23.3	.3	2.8	.7	39.8	12.5	52.3

WORK-RELIEF HIGHWAY PROJECTS

Work-relief highway projects, begun in the fall of 1933 to relieve distress in particular areas stricken by drought and a scourge of grasshoppers, became even more important in the fall and winter of 1934 when the effect of the drought on the rural population reached its peak. In the worst stricken areas road work was carried on by an arrangement under which the Public Works Administration granted amounts necessary to pay costs of materials and equipment, limited to not more than 30 percent of the total expenditure, and the Federal Emergency Relief Administration supplied from its relief rolls and paid the necessary workers.

Under this arrangement the Bureau of Public Roads, cooperating with the respective State highway departments, assumed the responsibility of supervising the road work.

Work of this sort has been carried on in 10 States on 8,727 miles of road. The number of projects in each State, the estimated cost and amount payable from Public Works funds, and the mileage of road involved are given in table 31.

TABLE 31.—*Number and estimated cost and mileage of National recovery work-relief projects undertaken to June 30, 1935, and Public Works funds involved*

State	Projects	Estimated total cost	Public Works funds	Mileage
	Number	*Dollars*	*Dollars*	*Miles*
Colorado	3	600, 000. 00	180, 000. 00	173. 5
Florida	1	1, 000, 000. 00	300, 000. 00	(1)
Kansas	18	2, 100, 000. 00	630, 000. 00	611. 8
Minnesota	39	3, 221, 200. 11	786, 937. 44	566. 6
New Mexico	6	970, 000. 00	291, 000. 00	309. 9
North Dakota	42	3, 457, 742. 65	900, 000. 00	1, 421. 2
Oklahoma	6	1, 900, 000. 00	570, 000. 00	442. 7
South Dakota	55	4, 036, 055. 45	990, 000. 00	1, 873. 7
Texas	64	8, 180, 437. 20	2, 454, 131. 07	1, 170. 8
Wisconsin	44	4, 448, 020. 47	883, 418. 44	2, 156. 6
Total	278	29, 913, 455. 88	7, 985, 486. 95	8, 726. 8

[1] Repairs to roads and bridges damaged by floods.

LOAN-AND-GRANT HIGHWAY PROJECTS

Under the provisions of section 203 of the National Industrial Recovery Act, the Public Works Administration continued the policy adopted in the preceding year of financing or aiding, by loans or grants or both, in the financing of the construction of roads in a number of States. The road-building activity thus provided for was additional to all other projects initiated under the grants specifically authorized for highway construction by sections 204 and 205 of the act.

The detailed administration of this work was transferred to the Bureau of Public Roads by the Public Works Administration in 1934, and by the end of the fiscal year 1935 allotments amounting to over $33,000,000 were under supervision. The status of the work is given in table 32.

TABLE 32.—*Status on June 30, 1935, of loan-and-grant Public Works projects transferred by the Public Works Administration to the Bureau of Public Roads for supervision and audit*

State	Funds allotted by Public Works Administration			Mileage, estimated cost, and funds assigned to specific projects approved under Public Works Administration allotments				
	Tentative allotment by Special Board for Public Works	Allotment by contracts executed		Miles	Estimated total cost	Funds assigned		
		Grant	Loan			Grant	Loan	Other
Alabama	$72,200.00	$19,700.00	$52,500.00	6.4	$62,882.00	$18,471.58	$44,410.42	
California	1,510,300.00	1,510,300.00		14.0	4,462,635.11	1,239,716.80		$3,222,918.31
Connecticut	1,087,744.73	1,087,744.73		68.7	4,640,485.62	1,042,403.95		3,598,081.67
Illinois	2,386,700.00	2,386,700.00		90.1	7,499,137.80	2,226,778.05		5,272,359.75
Indiana	204,300.00	204,300.00		34.5	752,308.36	196,792.94		555,515.42
Iowa	336,109.73	336,109.73		715.0	805,446.52	235,703.24		569,743.28
Kansas [1]	5,122,353.96	1,529,803.96	3,592,000.00	361.6	4,132,152.23	1,227,802.40	2,581,278.12	323,071.71
Louisiana	505,300.00	151,600.00	353,700.00	47.4	301,609.66	90,482.89	211,126.77	
Maryland	5,411,866.00	1,411,866.00	4,000,000.00	72.2	5,121,662.71	1,411,040.39	3,578,584.20	132,038.12
Massachusetts	1,608,987.99	1,608,987.99		105.1	5,484,222.19	1,578,142.94		3,906,079.25
Michigan	10,000.00	10,000.00		29.0	39,818.00	10,000.00		29,818.00
Minnesota	2,981,022.04	981,022.04	2,000,000.00	463.9	2,428,806.51	707,288.95	1,499,628.93	221,888.63
Mississippi	531,000.00	131,000.00	400,000.00	55.0	331,375.88	99,412.75	231,963.13	
Missouri [2]	1,026,000.00	1,500,000.00		49.6	2,188,717.45	608,897.08		1,579,820.37
Montana	1,829,000.00	579,000.00	1,250,000.00	697.4	1,984,510.06	482,508.36	1,225,376.49	276,625.21
Nebraska	11,500.00	11,500.00		59.5	40,120.22	11,500.00		28,620.22
New York [3]	1,490,700.00	1,161,799.90	2,170,933.10	30.9	1,550,572.65	440,550.94	488,018.83	622,002.88
Ohio [4]	87,902.77	85,102.77		11.8	237,026.20	69,800.47		167,225.73
South Carolina	98,000.00	29,000.00	69,000.00	28.0	63,888.00	19,166.40	44,721.60	
Texas [5]	2,036,393.31	1,142,793.31	1,218,600.00	213.9	3,044,736.92	896,924.15	493,291.20	1,654,521.57
Washington [6]	2,340,994.13	2,140,894.13		813.5	5,636,881.20	1,535,638.74		4,101,242.46
West Virginia	2,000,000.00	2,000,000.00		312.9	4,649,173.77	1,374,502.04		3,274,671.73
Wisconsin	454,800.00	148,550.00	306,250.00	119.5	398,554.65	116,889.65	232,375.97	49,289.03
Total	33,143,174.66	20,167,774.56	15,412,983.10	4,399.9	55,856,723.71	15,640,414.71	10,630,775.66	29,585,533.34

[1] Grant to be increased $550.
[2] Grant to be reduced $474,000.
[3] Loan and grant to be reduced $1,842,033.
[4] Grant to be increased $2,800.
[5] Loan to be canceled, $325,000.
[6] Grant to be increased $200,100.

NATIONAL FOREST ROAD CONSTRUCTION

The two principal classes of forest roads are designated, respectively, forest highways and forest development roads. The latter, as the name implies, serve primarily for the development of the forests; the former are roads of a higher order of traffic importance, generally those joining sections of the Federal-aid or State highway systems outside of the forests, or important community-service roads requiring improvement generally more expensive than that required on forest development roads.

In the main, the work supervised by the Bureau of Public Roads is limited to the construction of forest highways; forest-development road work is generally administered by the Forest Service. But, while this definition of the work of the two Bureaus is approximately correct, the exact line of separation is drawn between what are termed major and minor projects. Major projects administered by the Bureau of Public Roads include all projects in the forest highway system except those that do not require the technical services of a highway engineering organization or those having an estimated average cost of less than $2,000 per mile. Those forest development road projects of estimated average cost greater than $5,000 per mile and those requiring technical services are also classed as major projects.

Work conducted during the past year has been done partly with funds remaining at the beginning of the year from the allocations made during the preceding year by the Public Works Administration, of $15,000,000 for forest highways, and $10,000,000 for forest development roads. These allocations were made under authority of the National Industrial Recovery Act. In December 1934 the forest highway funds were reduced by withdrawal of $400,000 to be used for other road purposes. At the beginning of the year additional funds became available through the Hayden-Cartwright Act, which authorized an appropriation of $24,000,000 for the various classes of road work in federally controlled areas. Of this amount, the allotment for forest highways was $7,000,000 and that for forest development roads $3,000,000. Similar amounts have been made available under the Hayden-Cartwright Act for the fiscal year 1936.

In accordance with requirements of the governing rules and regulations a system of forest highways has been designated by concurrent action of the several State highway departments, the Forest Service, and this Bureau, and approved by the Secretary of Agriculture. Also, as required by the rules and regulations, the highways constituting this system have been classified as follows:

Class 1. Forest roads forming sections of the Federal-aid highway system, either wholly within or, when so designated by the Forester and the Chief of the Bureau of Public Roads, partly without and adjacent to the national forests.

Class 2. Forest roads, not of class 1, which are parts of approved State highway systems, when so designated by the Forester and the Chief of the Bureau of Public Roads.

Class 3. All other forest roads, of primary importance to counties or communities.

The roads which, according to these definitions, had been classified as forest highways, had an aggregate length on June 30, 1935, of 17,363 miles, classified as shown in table 33.

TABLE 33.—*Classification of the mileage of the forest highway system as revised to June 30, 1935*

State	Mileage of forest highway system			
	Class 1	Class 2	Class 3	Total
Western:				
Alaska			484.9	484.9
Arizona	327.8	245.0	495.9	1,068.7
California	584.0	1,344.5	531.5	2,460.0
Colorado	511.0	1,166.0	76.0	1,753.0
Idaho	722.2	176.6	184.5	1,083.3
Montana	628.3	335.8	240.0	1,204.1
Nevada	104.8	206.1	148.3	459.2
New Mexico	164.0	518.0		682.0
Oregon	720.8	324.5	318.6	1,363.9
South Dakota	227.0		86.0	313.0
Utah	96.6	536.3	110.2	743.1
Washington	386.5	135.4	247.9	769.8
Wyoming	387.3	37.0	217.7	642.0
Total	4,860.3	5,025.2	3,141.5	13,027.0

TABLE 33.—*Classification of the mileage of the forest highway system as revised to June 30, 1935*—Continued

State	Mileage of forest highway system			
	Class 1	Class 2	Class 3	Total
Eastern:				
Alabama	4.0		31.0	35.0
Arkansas	192.3	144.3	90.5	427.1
Florida	39.7	135.0	36.3	211.0
Georgia	41.8	37.5	68.7	148.0
Illinois			24.0	24.0
Kentucky	41.0	58.0	13.0	112.0
Louisiana	48.3	118.7	38.0	205.0
Maine			11.0	11.0
Michigan	49.9	108.5	150.3	308.7
Minnesota	89.5	89.1	133.1	311.7
Mississippi	32.0	13.0	78.0	123.0
Missouri			5.0	5.0
Nebraska			28.8	28.8
New Hampshire	41.5	60.5	49.0	151.0
North Carolina	102.0	105.3	48.3	255.6
Oklahoma	31.5		70.5	102.0
Pennsylvania	134.0	250.9	39.0	423.9
Puerto Rico			21.0	21.0
South Carolina		26.0	11.0	37.0
Tennessee	83.8	105.0	79.0	267.8
Texas			21.0	21.0
Vermont	7.0		12.0	19.0
Virginia	79.0	127.9	210.0	416.9
West Virginia	137.0	182.0	62.0	381.0
Wisconsin	5.0	148.9	136.1	290.0
Total	1,159.3	1,710.6	1,466.6	4,336.5
Grand total	6,019.6	6,735.8	4,608.1	17,363.5

During the past year improvements were completed on 1,232 miles of the forest highway system, bringing the total mileage improved to date with Federal funds to 6,231 miles. Of the mileage improved during the year, 1,150 miles were in the Western States and Alaska, and the remaining 82 miles were in the forests of 16 Eastern States. Of the total mileage improved to date, 5,706 miles are in the West, and 525 miles are in the East.

The mileage of forest highway projects completed during the year and to date by States is shown in table 34.

TABLE 34.—*Mileage of completed forest-highway projects, by States*

State	Mileage of forest-highway projects completed		State	Mileage of forest-highway projects completed	
	During 1935	Total to June 30, 1935		During 1935	Total to June 30, 1935
Western:			Eastern—Continued.		
Alaska	25.1	248.1	Florida	5.0	61.6
Arizona	119.2	526.5	Georgia		21.4
California	142.9	757.9	Illinois	1.5	1.5
Colorado	117.0	496.6	Michigan	20.5	38.9
Idaho	103.2	640.3	Minnesota	5.0	108.8
Montana	110.4	571.1	Nebraska	8.7	8.7
Nevada	34.2	152.9	New Hampshire		13.2
New Mexico	104.9	298.1	North Carolina	3.2	49.6
Oregon	171.8	970.1	Oklahoma	15.4	15.4
South Dakota	14.6	61.2	Pennsylvania	3.0	6.0
Utah	48.0	329.7	South Carolina		15.6
Washington	45.8	307.7	Tennessee		37.4
Wyoming	112.9	346.3	Virginia	5.2	21.0
			West Virginia	2.6	6.2
Total	1,150.0	5,706.5	Total	82.2	524.7
Eastern:					
Alabama		5.1	Grand total	1,232.2	6,231.2
Arkansas	12.1	114.3			

On June 30, 1935, work was in progress under the supervision of the Bureau of Public Roads on 738 miles of road at a total estimated cost of $7,274,505. Work estimated to cost $5,768,608 had been planned but not yet started; and there was a balance of authorized funds not yet obligated to definite projects amounting to $2,786,021.

ROAD CONSTRUCTION IN NATIONAL PARKS

During the fiscal year 1935 construction was completed on a total of 99 miles of roads in national parks, making a total of 930 miles thus far improved. Under an agreement of several years' standing construction of these roads is supervised by the Bureau of Public Roads.

The mileage constructed during the fiscal year and to date in the several parks is shown in table 35.

TABLE 35.—*Mileage of national-park roads improved under the supervision of the Bureau of Public Roads*

National park or monument	Completed during fiscal year 1935	Total completed to June 30, 1935	National park or monument	Completed during fiscal year 1935	Total completed to June 30, 1935
	Miles	*Miles*		*Miles*	*Miles*
Acadia	0.6	8.4	Morristown	1.7	1.7
Bryce Canyon	5.7	21.9	Mount Rainier	1.8	63.1
Carlsbad Caverns	8.4	8.4	National Capital Parks	1.1	1.8
Colonial National Monument	9.4	20.4	Petersburg	3.5	3.5
Crater Lake	4.2	45.8	Petrified Forest	0	26.3
Devil's Tower National Monument	0	.3	Rocky Mountain	4.2	43.1
General Grant	0	6.4	Scotts Bluff	0	.6
Glacier	1.3	55.7	Sequoia	3.4	42.7
Grand Canyon	3.3	154.4	Shenandoah	0	40.1
Great Smoky Mountains	0	4.0	Wind Cave	.6	15.9
Hawaii	10.7	35.6	Yellowstone	22.5	178.6
Lassen Volcanic	4.9	35.3	Yosemite	11.6	76.7
Mesa Verde	0	20.4	Zion	0	18.9
			Total	98.9	930.0

Bureau activities continued in all parks and monuments during the year. Nearly all of the newly acquired military parks, battlefields, and cemeteries have at least one project under construction, and some of the larger areas have considerable road construction under way.

In the Western States the Red Lodge-Cooke City National Park approach road to Yellowstone National Park and the Cameron-Desert View approach road to Grand Canyon National Park are practically completed. Both of these projects will be finished during the present construction season.

Carlsbad Caverns National Park road improvements show completed mileage for the first time. A project 8.4 miles in length was completed in that park during the past year.

The road program in Shenandoah National Park is progressing rapidly. Three sections of road aggregating approximately 30 miles between Front Royal and Panorama are at present under construction. The section between Panorama and Swift Run Gap was surfaced during the fiscal year and is being visited by tourists from many Eastern States.

On one section of the Shenandoah-Great Smoky Mountains Parkway, connecting Shenandoah National Park in Virginia with the Great Smoky Mountains National Park in North Carolina and Tennessee, construction is ready to begin, and plans and surveys have been completed for several other sections. The parkway will be about 450 miles long, 210 miles in Virginia and 240 miles in North Carolina. When completed, this road will extend along the crest of the Blue Ridge Mountains and will be a beautiful scenic drive.

The Green Mountain Parkway in Vermont and the Natchez Trace in Tennessee and Mississippi are two other large eastern projects that were being surveyed at the end of the year.

On June 30, 1935, over $16,000,000 of road work had been placed under contract from funds provided by the National Industrial Recovery Act. Of this amount, approximately $9,500,000 is involved in work under construction in the West and $6,500,000 in the East. In addition to this amount, about $2,300,000 of work has been begun under the Hayden-Cartwright Act, of which approximately $1,800,000 represents work in the West and $500,000 work in the East.

INTER-AMERICAN HIGHWAY

A report on the proposed Inter-American highway was made by the Bureau in November 1934 and has been published as Senate Document No. 224. This report covers a reconnaissance survey of the proposed route through Panama and the republics of Central America, and includes detailed discussion of the engineering and economic considerations presented by this project. It is illustrated with photographs and numerous plan and profile maps.

In March 1935 the Bureau reopened the office at Panama City, Republic of Panama, that it had maintained with the cooperation of the Central Road Board of Panama during the reconnaissance-survey operations, and assigned to it a senior highway engineer and a senior economist. In May a field party began location surveys in the western portion of Panama, to fix the exact route that the highway will follow between Concepcion and the Costa Rican border. Construction of this section will complete the highway in Panama.

A representative of the Bureau visited the seven countries through which the highway will pass—Panama, Costa Rica, Nicaragua, Honduras, El Salvador, Guatemala, and Mexico—during the latter half of the fiscal year, and interviewed high government officials regarding their plans for developing the highway, particularly with reference to their cooperation with the United States Government in construction activities, for which the Congress in 1934 appropriated $1,000,000.

TRANSPORTATION, ECONOMIC, AND STATISTICAL INVESTIGATIONS

NEW JERSEY TRAFFIC SURVEY

A survey of traffic upon the entire State highway system of New Jersey and a limited mileage of county routes was completed and a report made to the State highway department. A digest of the report has been published in Public Roads. The report contains a traffic classification of all State highways and recommendations for pavement and right-of-way widths for the entire State system.

It was shown that each mile of the State highway system is used, on an average, by 4,659 vehicles a day, a fact which places the New Jersey system among the most intensely used highway systems in the country. A heavy traffic was found entering the State at Hudson River and Delaware River crossings, and 16.3 percent of this traffic was found to pass through New Jersey. In a special study of motor-truck traffic it was discovered that owner-operated trucks constituted 79 percent of truck traffic, contract-hauler trucks 17.7 percent, common-carrier trucks 2.2 percent, and Government-operated trucks 1.1 percent. Sixty-six out of each 100 trucks had both their origin and destination within the State. Seventy-two percent of owner-operated trucks were engaged in intrastate traffic, as compared with but 37 percent of contract haulers and 32 percent of common-carrier trucks. Manufactured products were carried by 56 percent of the loaded trucks, agricultural products by 20 percent, and 11 percent were engaged in retail delivery. Trucks up to 1½ tons capacity constituted 55.5 percent of the total number; those of capacities of from 1½ to 5 tons, 23.3 percent; and those of 5 tons capacity and over, 21.2 percent.

FLORIDA TRAFFIC SURVEY

A report of a survey of traffic upon the State highway system of Florida was submitted to the State road department and published by that department. A digest of the report was published by the Bureau. The report contained data for use in planning future highway improvements in the State and much information in regard to the amount and character of two of the most important highway movements—the tourist traffic and the movement of citrus fruits. Tourist expenditures in Florida were estimated to be approximately 90 million dollars

annually, one-third spent by those stopping in hotels and another third spent by home owners. Expenditures per party per day were found to vary from an average of $8.81 per day for those stopping at hotels to the $2.63 per day for camping parties. It was estimated that the fuel tax paid by tourists to the State of Florida amounts to about $2,600,000 a year.

Fifteen percent of the 215,600 outgoing trucks crossing the Florida State line during the year carried citrus fruits. About 88 percent of the total interstate truck shipments of citrus fruit were shown to be destined to Georgia, South Carolina, Alabama, North Carolina, Tennessee, the District of Columbia, and Virginia. Georgia and South Carolina accounted for more than half the total.

CONNECTICUT TRAFFIC SURVEY

Field work on a survey of traffic in Connecticut terminated in October 1934, and the report is practically completed. As a special phase of this survey, the speed at which nearly 90,000 vehicles were traveling was determined by stop watch at 78 points on the rural highways. The average observed passenger-car speed slightly exceeded 40 miles per hour, while trucks averaged a little below 35 miles per hour. The effect of weather, road types, and other variables will be analyzed in a separate report.

ARKANSAS TRAFFIC SURVEY

Field work on a survey of traffic in Arkansas was completed in June 1935 and preparation of a report begun. This survey, conducted in cooperation with the State Highway Commission of Arkansas, will provide data on the usage of the entire State highway system and serve as a basis in planning future improvement.

TRAFFIC CAPACITY AND INTERSECTION STUDIES

Studies of the speed of vehicles in relation to traffic density and highway capacity have been initiated. Field observations conducted during the summer on a number of important highways of various types in the vicinity of Boston, Mass., provided detailed records of individual-vehicle speeds over a wide range of traffic volume. From these records effort will be made to determine the traffic capacity of highways, the effect of slow vehicles upon such capacity, and the range of speed under given circumstances of traffic density.

Studies of the effect of control methods on traffic delay at intersections have been continued during the year.

NATIONAL CONFERENCE ON STREET AND HIGHWAY SAFETY

The Bureau continued its cooperation with the executive committee of the National Conference on Street and Highway Safety, particularly with regard to presenting and explaining the five acts of the Uniform Vehicle Code to legislative bodies and civic groups in various States. The progress being made in the adoption of this uniform legislation, which is one of the most important elements in the Nation-wide campaign to promote highway safety, is evidenced in table 36, showing the status of adoption to date of substantial parts of the code. The nine States and the District of Columbia in which legislation has been enacted in 1934 and 1935 are indicated by figures in parentheses.

TABLE 36.—*States with motor-vehicle laws containing substantial parts of the Uniform Vehicle Code, as of June 30, 1935*

Act 1, uniform motor-vehicle administration, registration, certificate of title, and antitheft act [1]	Act 2, uniform motor-vehicle operators' and chauffeurs' license act	Act 3, uniform motor-vehicle civil-liability act	Act 4, uniform motor-vehicle safety-responsibility act	Act 5, uniform act regulating traffic on highways [2]
Arizona	Arizona	California	Arizona (1935)	Arizona
California	California [3]	Colorado	California	California
Colorado	Colorado	Connecticut	Colorado (1935)	Colorado
Delaware	Connecticut [3]	Delaware	Connecticut	Delaware
District of Columbia	Delaware [3]	Idaho	Delaware	Idaho
Florida	District of Columbia [3]	Illinois	District of Columbia (1935)	Louisiana
Georgia	Idaho (1935) [3]	Indiana	Indiana	Maine
Idaho	Indiana	Iowa	Iowa	Michigan
Indiana	Iowa	Kansas	Maine	Minnesota
Louisiana	Kansas	Massachusetts	Maryland	Nebraska
Maryland	Kentucky (1934)	Michigan	Michigan	New Hampshire
Michigan	Maine	Minnesota	Minnesota	New Jersey
Missouri	Maryland [3]	Montana	Nebraska	New Mexico
Montana	Massachusetts [3]	Nebraska	New Hampshire	North Carolina
Nevada	Michigan	New York	New Jersey	North Dakota
New Mexico	Minnesota	Nevada	New York	Oregon
North Carolina	Montana (1935)	North Dakota	North Carolina	Pennsylvania
North Dakota	Nebraska	Ohio	North Dakota	South Dakota
Oklahoma	Nevada	Oregon	Ohio (1935)	Utah
Oregon	New Hampshire [3]	Pennsylvania	Oregon (1935)	Virginia
Pennsylvania	New Jersey [3]	Rhode Island	Pennsylvania	Washington
South Dakota	New York [3]	South Dakota	Rhode Island	Wisconsin
Utah	North Carolina (1935) [3]	Texas	South Dakota	
Virginia	North Dakota (1935)	Vermont	Vermont	
West Virginia	Oregon [3]	Washington	Virginia	
Wisconsin	Pennsylvania [3]	Wyoming	Wisconsin	
	Rhode Island [3]			
	South Carolina			
	Utah [3]			
	Virginia [3]			
	Vermont [3]			
	Washington [3]			
	West Virginia [3]			
	Wisconsin			

[1] All States have some form of registration laws. The States listed in this column have laws conforming more closely to the provisions of act 1 of the code than do the other States.

[2] All States have some form of rules of the road and equipment requirement laws. The States listed in this column have laws conforming more closely to the provisions of act 5 of the code than do the other States.

[3] Has full standard licensing system, including examination of new drivers, suspension and revocation of licenses for cause, and a strong centralized administration. Other States listed have licensing laws, but for various reasons are not considered standard.

STUDIES OF TAXATION

Reports on State finances, with special reference to highways, were completed for New Hampshire and Minnesota. Similar studies in New York, Colorado, Wyoming, and New Mexico, are nearing completion. These investigations are part of a series designed to establish the relation of highway taxes paid from different sources and by different groups of citizens to highway expenditures, and to lay down a broad basis for the adjustment of highway taxes on a rational plan.

MOTOR-VEHICLE TAXATION IN 1932

Practically complete data on motor-vehicle taxation were made available for the first time in the report, Taxation of Motor Vehicles in 1932, published in October 1934. The detailed public charges borne by motor-vehicle owners are itemized in this report as to taxing jurisdictions, types of vehicles, and classes of taxes and fees. Total fees and taxes in 1932 are shown to have been $1,001,150,000, of which approximately $92,000,000 were accounted for by Federal manufacturers' excise taxes, $839,000,000 by State fees and taxes, and the remainder by public bridge and ferry tolls, county and municipal fees and taxes, and personal-property taxes.

RAILROAD LINE ABANDONMENT STUDIES

The arrangement made with the Interstate Commerce Commission and the American Railway Association, whereby the Bureau undertook to make studies of branch lines and sections of railroad that it was proposed to abandon, with a view to ascertaining the effect of such action on highway traffic in the immediate vicinity, was continued through the year. Thirty-six cases were studied, involving 1,042 miles that it was proposed to abandon, distributed among the States as shown in table 37.

TABLE 37.—*Sections of railroads that it was proposed to abandon inspected during fiscal year*

State	Projects	Railroad	Highways inspected	State	Projects	Railroad	Highways inspected
	Number	*Miles*	*Miles*		*Number*	*Miles*	*Miles*
Alabama	1	7.10	41	New York	2	54.50	121
Arkansas	1	26.40	54	North Dakota	1	11.10	15
Georgia	1	56.66	111	Pennsylvania	2	22.80	32
Indiana	2	69.69	104	South Carolina	1	76.50	125
Iowa	4	126.60	219	South Dakota	3	65.44	122
Kansas	2	59.73	72	Tennessee	3	71.63	182
Maine	1	36.00	86	Vermont	1	19.34	20
Maryland	1	25.63	54	West Virginia	1	19.97	30
Michigan	2	123.73	174	Wisconsin	1	8.91	27
Minnesota	1	17.50	57	Wyoming	1	44.73	87
Mississippi	2	41.59	134				
New Jersey	1	8.36	25	Total	36	1,041.93	1,955
New Mexico	1	48.02	63				

This work was done to determine which secondary or other roads should be built to serve communities now served by these railroads.

MAINTENANCE COST STUDIES

Agreements were made in April 1935 with the State highway departments of Connecticut, New Hampshire, and Rhode Island to study highway-maintenance costs in relation to traffic volume. Field work was begun shortly thereafter by counting traffic on selected road sections that afford an adequate sample of all types of construction. Careful records will be kept of maintenance expenditures on these road sections.

PAVEMENT LIFE STUDIES

A study of the actual service life of various types of highway and street pavement was begun in cooperation with the Iowa Engineering Experiment Station of Iowa State College. Records of State, county, and municipal highway departments are being studied to determine the age of pavements, including those in use and those that have been replaced, and to develop mortality curves for use in highway planning. Data have been collected on the highways of Wayne County, Mich.; the State trunk-line system of Michigan, the State roads of Massachusetts, Vermont, New Hampshire, Connecticut, and Rhode Island; and the street systems of Des Moines, Iowa, and Buffalo, N. Y.

TRAFFIC SAFETY SURVEYS

In Rhode Island and South Carolina cooperative traffic-safety surveys were conducted during the year as white-collar relief projects. Volume and type of traffic, speed of vehicles, and obedience of drivers to traffic-control devices were recorded in the field, and the data were subsequently analyzed in detail. A report on the Rhode Island survey has been made to State authorities and that on the South Carolina survey is in preparation.

At the request of the Federal Emergency Relief Administration, the Bureau detailed a traffic engineer to advise with the local directors in preparing reports on traffic-safety surveys in the cities of Chattanooga, Knoxville, Memphis, and Nashville, Tenn. Field work on these surveys, begun under the Civil Works Administration, had been completed, but assistance was needed in the analysis and interpretation of the data. The completed reports include an analysis of accident data, traffic volume, the obedience to traffic-control devices and regulations, and recommendations for the improvement of street traffic conditions.

HIGHWAY MANAGEMENT AND PRODUCTION COST STUDIES

PRODUCTION ON RELIEF PROJECTS

During the past year requirements in the administration of the enlarged emergency highway program, especially those pertaining to the employment of labor, have necessitated new studies to determine more definitely the amount of labor provided by a given expenditure and how this varies with such factors as type of construction, methods of operation, region in which the work is located, and the season when performed. Such information is essential to the proper planning of road work for employment relief and prerequisite to formulating adequate means and methods for a material reduction of the present rather large seasonal fluctuations in highway employment.

These studies already have produced much definite data as to the practical value of highway work as a relief measure. For example, the expenditure for drought-relief road work in the 18 southwestern counties of Kansas to January 1, 1935, amounted to $1,458,906. As a return for this expenditure the drought-stricken farmers were provided not only with employment sufficient to give a measure of support to themselves, their families, and their livestock, but their work had been utilized so effectively that their communities had been provided with substantial road improvements involving 409 miles of grading and 209 miles of surfacing with gravel and selected materials. The grading required the movement of 5,061,584 cubic yards of earth, and the surfacing involved the placing of 229,979 cubic yards of gravel and other selected materials.

The expenditures for this work were distributed as follows:	*Percent*
Labor	54. 8
Teams	18. 3
Trucks	6. 0
Supervision	3. 7
Materials	9. 4
Engineering	7. 8
Total	100. 0

Both teams and trucks were hired almost entirely from the local farmers. Foremen and much of the help employed by the resident engineers and most of the materials were obtained locally. Consequently, a large part of every dollar expended served to provide immediate and direct local relief.

EMPLOYMENT IN ROAD CONSTRUCTION

Studies have been continued of those types of highway construction in which mechanical equipment plays an important part to determine more definitely the returns that accrue to labor. On such work the expenditure for direct employment on the job may be as low as 14 to 20 percent of the daily cost. All available data, however, indicate that, in spite of this relatively small use of labor directly on the job, the proportion of the total expenditures that eventually reaches workers through more or less indirect channels is very large, seldom less than about 85 percent of the total cost of the improvement.

Studies have shown quite clearly that, on the average high-type road construction job, a large proportion of the primary expenditures for materials, transportation, equipment and supplies eventually accrues to labor. Materials require labor and equipment for their production and transportation. Supplies are used up and require labor and equipment for their production. Equipment wears out and requires labor for its repair and renewal. The benefits to labor and business by the construction of high-type road improvements are therefore not localized but widely diffused. These benefits are not confined simply to the immediate employees directly on the job but extend to such diverse industries, as rock quarries and sand pits, cement mills, asphalt and oil works, railroads, trucking and other transportation agencies, steel and lumber mills, powder works, coal and ore mines, and to all agencies that produce, transport, store, or deal in the many products required directly and indirectly in highway construction. A report resulting from these studies is being published.

Considerable time has been devoted to obtaining adequate records of the amount of employment provided by the current State and Federal highway-construction program. A monthly record is compiled of the number of persons employed in each State on work involving either State or Federal funds. Comparisons of the number of names on pay rolls with the size of the average working force indicate that the number of pay-roll names exceeds by 30 percent the

average number of individuals working throughout the pay-roll period. The percentage varies with the type of work. Weather, seasons of the year, efficiency of the job management, and industrial conditions appear to have an appreciable influence on the rate at which laborers change employment.

ESTIMATING STANDARDS

In estimating the cost of highway construction there is often considerable difference between the engineer's estimate and the bid of the low bidder. The estimates of the various bidders frequently cover a wide range. Highway engineers have need for more accurate methods of estimating costs as a basis for highway programs, and contractor's profits depend on the accuracy of their estimates.

Efforts have been made during the past year to develop standard forms, definitions, and subdivision of items that will permit the engineer and the contractor to prepare their estimates on a common basis. These proposed standards are now being tried on a number of jobs. Indications are that these standards, if generally adopted, will bring about a decided improvement in methods of estimating.

INDEX FIGURES

A study of highway-construction costs during the past 10 years for the country as a whole reveals wide variations in unit costs of labor and materials and a general downward cost trend. However, the reduced costs of the components have not been reflected directly in the cost per mile of highways constructed. More intense highway usage and public demand have brought about higher standards of construction, such as wider roadways, better alinement, reductions of grades, and general roadside beautification. This has tended to bring the cost per mile of highway construction to a more uniform level. Tables are in preparation which will show both cost and usage variations in terms of index numbers for the years 1927 to 1934.

UNIT COST AND PRODUCTION STUDIES

Administrative work in connection with the emergency highway program has made it necessary to curtail the usual unit cost and production studies during the past 2 years. Some phases of former studies have been completed and published. A limited amount of work is under way largely in connection with the development of improved standards for preparing cost estimates and determining the number of man-hours and equipment-hours involved in the numerous items of highway construction. More precise knowledge of the amount of human labor required in each road-building and maintenance operation and the extent to which the labor element varies with different methods and different kinds of equipment is an urgent need.

HIGHWAY ACCOUNTING METHODS

Efforts to further the development and installation of efficient accounting procedures by highway-building agencies have been continued. The Bureau has a direct interest in such procedures because of its cooperation with the States in road construction and also its service in supplying general information on highway income and expenditure and costs of construction and maintenance by types. Efficient statistical and accounting control is necessary for administrative reasons and also to provide the engineering organization with the proper means for determining costs and properly comparing the relative merits of new and old procedures, methods of operation, and types of organization. For accumulations of experience and data to be of the greatest possible value it is necessary that statistical methods, terms, and nomenclature be uniform so that the accomplishments of one State can be compared fairly with those of any other. As yet, such comparisons can be made only between a few States. The aim of the Bureau is to provide a system of accounts and records that will be economical in operation, will meet all of the accounting requirements of a State highway department, and provide quickly and in practical form complete statistical information on any desired activity in which the department is engaged, fully comparable with similar activities in any other State. Cooperative work of this type was continued during the year.

PHYSICAL RESEARCH

SUBSURFACE EXPLORATION

Subsurface exploration is a new line of research in which instruments and field technic for the location and identification of subsurface formations of rock and other materials of importance in highway work are being developed. This work was mentioned briefly in the last annual report. During the past year the two types of equipment being investigated, the resistivity apparatus and the seismic apparatus, have been given extensive field tests in Maryland, Virginia, and in the District of Columbia. Subsurface explorations have been made in connection with work of the Navy Department, the National Park Service, the Bureau of Mines, the bridge department of the District of Columbia, and the Bureau of Public Roads. In several places where subsequent excavation, test pits, or core borings permitted a comparison between the prediction made and the actual depth to rock the agreement was close. A description of the apparatus and its use has been published by the Bureau in Public Roads.

INVESTIGATION OF CONCRETE-PAVEMENT DESIGN

A major investigation relating to concrete-pavement design and information about the structural action of concrete pavements, is nearing completion. The investigation has been divided into four principal parts: (1) A study of the effects of temperature and of moisture on the structural action of concrete pavements; (2) the development of basic information on the design of slab cross sections; (3) a comparative study of the structural action of a number of typical joint designs under the action of applied loads; and (4) an experimental study of the Westergaard method of analysis of stresses in pavement slabs.

Most of the field work has been completed, and reports have been drawn up describing the project and giving the final results of the first two parts. Similar reports covering the last two parts are in preparation. These reports will provide reliable information on the structural action of concrete pavements and should aid in securing more economical pavement design.

MOTOR-VEHICLE IMPACT INVESTIGATIONS

The study of the elastic properties of concrete under static and impact forces is the present active research in the general field of motor-vehicle impact. In order to use the information previously developed by the Bureau about motor-vehicle impact, a study is being made of the effect on pavements of impact forces as compared with statically applied forces. The development of test apparatus for these studies has been a difficult problem, but it is thought that the instrumental difficulties have been overcome. Testing already completed indicates that the present equipment is satisfactory.

MEASUREMENT OF ROAD SURFACE ROUGHNESS

The use of a roughness indicator mounted on a standardized, single-wheel vehicle has already been reported. Damping the free period of oscillation of such a vehicle was found necessary. It is believed that satisfactory spring damping has been obtained with specially designed hydraulic damping devices. The complete surface-roughness measuring apparatus is being tested on roads of various degrees of roughness and under as wide a range of temperature as possible in order to determine its limitations.

HIGHWAY BRIDGE INVESTIGATIONS

The tests to determine the friction developed in the sliding expansion bearings in highway bridges, mentioned in last year's report as practically completed, have been finished. Certain additional tests suggested by the results of the original investigation have also been made. The complete results of the entire investigation are included in a nearly completed report.

INVESTIGATION OF CORRUGATED METAL CULVERTS

The investigation of corrugated metal culverts is primarily a study of an erosion test for bituminous-coated corrugated-metal culvert pipe. This erosion test has been developed in Connecticut, and is proposed by that State as a criterion for the acceptance of metal culvert pipe coated internally with asphalt. The Bureau study includes the test and specification as proposed and also the

effect of some of the variables involved. A testing machine has been built and arrangements made with three other agencies for a series of check tests to determine how closely various laboratories can be expected to check each other in making the present test.

THE STUDY OF FLEXIBLE TYPES OF HIGHWAY SURFACES

The Bureau has begun a systematic attack on another important problem. A study is being made of the manner in which flexible types of road surfacing act in supporting traffic loads. New information is sought with which to rationalize methods of determining the thickness of flexible pavements. This problem is complex, but its importance warrants thorough and painstaking study.

NONBITUMINOUS ROAD MATERIALS

The investigation of the effect of chemical composition of portland cement on the durability of concrete, started last year, is being continued. A number of cements of widely varying composition, in combination with sands of good and poor quality, are being subjected to an accelerated weathering test. The effect of varying the proportion of cement to sand as well as the effect of the length of the initial curing period prior to the weathering test are being studied. Although the investigation is incomplete, certain indications as to the comparative importance of the variables are: (1) That variations in the quantity of cement used, as controlled by variations in the water-cement ratio, are of greatest importance so far as durability is concerned; (2) that the effect of quality of sand is more pronounced in lean mixtures than in rich mixtures; and (3) that variations in the chemical composition of the cement are of minor importance as compared with the other two variables.

During the year considerable attention was given to the development of a suitable test for quality of coarse aggregates. Additional work on the Los Angeles abrasion test, referred to in the report of last year, has been reported. In this paper the results of tests on samples representing a large number of sources of crushed stone, gravel, and slag are given in conjunction with the service records of these materials in bituminous road construction. The satisfactory agreement between results in the Los Angeles test and service behavior indicates that this test meets the need that has existed for a more determinative test for the quality of aggregates.

A preliminary study of the results of tests to determine the effect of vibrating concrete placed in pavement slabs shows approximately the same results as were obtained in the tests reported in 1933. A detailed study is being made of the large volume of data.

During the past year concrete pavements were investigated in Alabama, Georgia, Mississippi, South Carolina, and Tennessee. Pavements built prior to 1930 were inspected for evidence of disintegration, and a record was made of the amount and degree of the disintegration found. Information was obtained as to the materials used in construction and the construction practices followed. These data are being analyzed in an effort to discover the causes of disintegration. The study of the many factors to be considered has not been completed, and no final conclusions have been drawn.

Work has been begun on a series of laboratory tests to determine the effect of "de-airing" on the quality of vitrified paving brick. De-airing is an improvement in manufacturing technic recently introduced. The process involves subjecting the clay to a high vacuum to remove air and thus increase the density of the brick.

The project is being carried on in cooperation with the National Paving Brick Manufacturers Association, and a parallel series of tests sponsored by the association is under way in the laboratory of the Ohio Engineering Experiment Station. Direct comparisons will be made between the quality of the de-aired brick now being manufactured in plants located in Pennsylvania, Ohio, Indiana, and Illinois, and the quality of brick from the same plants manufactured by the old process. Samples of light-burned, medium-burned, and hard-burned brick manufactured by each process are being subjected to several tests, including the standard rattler, compression, and flexure tests. Other special tests are designed to reveal improvements in quality effected by the new process.

BITUMINOUS ROAD MATERIALS

Research on bituminous materials and their uses in road construction has continued along the general lines followed in previous years. It has included laboratory examination of bituminous materials and aggregates, field studies

of problems in bituminous construction, and a continuation of the cooperative work with State highway departments and the asphalt industry in connection with the standardization of specifications and test methods for liquid asphaltic road materials.

Laboratory studies of the properties of asphalt cements, tars, emulsions, and other liquid asphaltic materials are in progress, seeking to provide new information about their physical and chemical properties, to determine the value of the commonly specified tests as indicators of probable service behavior, and to determine those properties that are indicative of quality in order that the requirements necessary for given conditions may be specified without reference to the source of the material or its method of manufacture. The materials studied are representative of the present production fields and of the products manufactured.

Progress reports on the work done on tars, emulsions, and liquid asphaltic materials are in preparation. The study of asphaltic cements begun recently was prompted by the growing tendency to include in specifications requirements of questionable value in the control of quality, which tend to restrict unduly the field of supply.

Variations in refinery practice, resulting from unbalanced demand for certain petroleum products, have resulted in the production of bituminous materials that show variation in service behavior that cannot be predicted from the results of present tests. It has become extremely important to devise tests or combinations of tests that will definitely indicate quality and probable service behavior.

Laboratory studies are being continued on bituminous mixtures of the hot and cold types to determine the factors governing service behavior. The study of the hot mixtures is a continuation of former work to develop suitable tests and test methods. The study includes cooperative work with the California Department of Public Works on mixtures of known behavior.

Mixtures of the low-cost type in which liquid bituminous materials are used are being tested on the small circular tracks, mentioned in previous reports. The tests are expected to yield information on resistance to weathering and the effect of such factors as the amount of moisture, the kind, quantity, and viscosity of bitumen, and the type and grading of aggregates. Reports on the completed phases of these studies are in preparation.

Studies of two experimental roads in cooperation with State highway departments were continued during the year but were discontinued at its close. These projects are in South Carolina and Nebraska. In South Carolina bituminous surfaces of several types constructed on sand-clay and marl bases were studied. In Nebraska poorly graded sand, known as "blow sand", combined with medium- and slow-curing asphaltic materials in the road-mix type of construction was investigated. The sand used in this project is typical of that found in a large area containing no other aggregate suitable for bituminous construction. Final reports on these two projects are being prepared.

Field studies of a number of low-cost types of bituminous construction were made during the year to obtain information on particular types of construction. Such studies included the penetration macadam built extensively in Pennsylvania during the last few years, the open-type, plant, and road-mix construction built extensively in Alabama on chert and other bases, and in Oklahoma on relatively thin bases constructed on soils of low capillarity.

Work in cooperation with the State highway departments and the asphalt industry to standardize specifications for liquid asphaltic road materials has been continued. During the past year regional meetings were held to discuss the results obtained with the tentative standard specifications previously proposed and to consider necessary modifications. This work will be continued.

SUBGRADE INVESTIGATIONS

Increasing interest in the use of information about subgrade soils has been shown by various State highway departments, and a number of them have established soil-testing laboratories. The Bureau has prepared a series of check samples that are sent to these laboratories on request for the purpose of standardizing the testing procedure. Procedures for the more commonly used tests have been prepared. These procedures have been adopted by the American Association of State Highway Officials and are being considered by the American Society for Testing Materials. Studies of routine test methods to ascertain the causes of discrepancies in test results obtained by different operators and the effect of test variables, such as temperature, humidity, etc., have been continued.

Tests of samples of caliche from bases of roads of good and poor service quality led to the publication of a report containing limiting test values for satisfactory varieties of this material. A similar report on limerocks has been prepared.

All investigations concerning soil stabilization have been combined under one project. A series of tests to determine the effect of physical and chemical admixtures on soils of the various subgrade groups is under way. These tests reveal the moisture content at which maximum compaction may be obtained and the densities that may be expected under various conditions of compaction and moisture. Tests on compacted samples are designed to show the resulting stability through measurement of percolation, expansion in the presence of water, and degree of softening when wetted. This series of tests will lead to the selection of mixtures to be investigated with use of a laboratory circular track. Promising developments from these tests will be investigated in the field.

When plastic soils are used in earth embankment construction, the best results are obtained only when moisture control and adequate compaction are provided. Certain soils are unsuitable for fill construction under any circumstances. Tentative specifications for the selection of embankment materials have been prepared and will be checked in practice. Continued investigation of the efficiency of different types of compacting equipment should furnish valuable information.

The low-cost-road field studies have included inspections and the tests of a number of samples from roads in service and correlation of test results and service behavior has resulted in a clearer understanding of the requirements for the improved soil road. A report, published in Public Roads, discussed the development and possibilities of this type of highway.

The large mileage of stabilized roads throughout the country emphasizes the necessity for suitable field apparatus for use in the selection of material and the control of the mixture. Considerable work has already been done on the drainage indicator for determining the percolation rate and capillary rise of soils. An extrusion test in conjunction with the drainage indicator gives promise of supplying valuable facts about the stability of graded mixtures. Further work on the sedimentation method for rapid mechanical analysis has led to the design of apparatus using a comparison microscope for determining grain sizes.

A cooperative investigation by the Bureau, the Missouri State Highway Commission, and the Missouri Agricultural Experiment Station was inaugurated in February 1935. Study is being made of the little-developed but highly important subject of surface chemistry of soils and base exchange in soil materials. It is indicated that a fuller understanding of the surface phenomena of soils will provide means for greatly altering the behavior of a given material. Progress is being made on the practical problem of utilizing wind-blown sand in highway construction. The use of soap as an electrolyzer in coating soil with bituminous material is a practical application resulting from a study of surface phenomena.

Three reports on specific projects, not previously mentioned, have been prepared for publication. They are: (1) A report on the microchemical method of analysis for the indentification of chemicals that may be present in soils and ground waters and seem to be associated with concrete disintegration and warping; (2) a report on the analysis of data collected on the hydraulic fill at Four Mile Run on the Mount Vernon Memorial Highway, containing a comparison of computed and measured settlements; (3) a progress report on the Virginia demonstration road, discussing the effect of subgrade conditions, type of aggregate, reinforcement, crack-control methods, method of curing, and other variables as revealed by the condition surveys.

Cooperation with the State highway departments in the making of subgrade surveys, in the design of subgrade treatments and road surfaces, and in the establishment of subgrade-soil laboratories, has continued as in past years.

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